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CHANDLER (F. B.). **Mineral nutrition of the genus Brassica with particular reference to boron.**—*Bull. Me agric. Exp. Sta.* 404, pp. [4]+ 307–400, 64 figs., 1941. [Abs. in *Exp. Sta. Rec.*, lxxxv, 5, pp. 631–632, 1941.]

In sand and water cultures the symptoms of boron deficiency in *Brassica* spp. (including cauliflower and swede) [cf. *R.A.M.*, xvii, p. 496; xviii, pp. 428, 817; xx, p. 554], which normally contain insufficient boron in their seeds to develop the cotyledons and first true leaves, were curling, rolling, and rugosity of the leaves, with chlorosis of the margins, swelling, splitting, and a corky appearance of the stems and petioles, accompanied by brittleness of the latter, development of brown areas in the stems, and a reduction in the size and quality of the edible portions. The undifferentiated cells of boron-deficient tissue elongated at random, thereby crushing other internal cells or producing swellings on the petiole and stem surfaces. In severe cases the cork cambium was not formed at all, and even when present it did not give rise to normal cells in boron-deficient plants. The root tip was the first part of the plant to show signs of boron deficiency (within a few days), and the apical meristem the last. The maximum total plant weight was obtained by continuous supplies of 0·3 or 0·5 p.p.m. boron.

GREIS (H.). **Die Pustelkrankheit der Zuckerrüben.** [The pustule disease of Sugar Beets.]—*Phytopath. Z.*, xiii, 4, pp. 369–374, 3 figs., 1941.

The fungus responsible for the production of pustules arising from a yellow, mucilaginous coating near the lateral roots of sugar beets in the early summer of 1940 in Germany was identified on the basis of its conidial dimensions (45 to 55 by 4 to 5·5 μ, average 52 by 4·8 μ) as *Fusarium betae* [*F. merismoides*: *R.A.M.*, xvi, p. 790]. The results of artificial inoculation experiments showed that the pathogen, which frequently causes the death of the plants, especially when young, normally enters its host through wounds, but is also capable of penetrating wilting tissues, even in the absence of injury. Living foliage and inflorescences are not attacked, but when dead they afford a suitable substratum for the fungus, which is transmitted by way of the seed clusters, having been found by the author in a number of German and foreign samples. As a rule the pustules originate in the groove of the lateral roots and thence spread over more or less extensive areas

of the beet. The disease occurs only in very moist soils, so that repeated hoeing to ensure aeration is a promising method of control.

Coons (G. H.). **The status of leaf spot varieties.**—*Proc. Amer. Soc. Sug. Beet Technol., East. U.S. & Can., 1941.* [Abs. in *Sugar*, xxxvi, 11, p. 40, 1941.]

During 1940, agronomic evaluations were conducted [in Michigan] on U.S. 200×215 and allied varieties of sugar beet in relation to leaf spot [*Cercospora beticola*: *R.A.M.*, xx, p. 618] resistance, comparisons being made with Synthetic Check, a variety obtained by pooling equal quantities of nine European brands and using this mixture to produce a seed crop. In general, the data confirm the results of the 1938 and 1939 tests, viz., that U.S. 200×215 may be used to replace standard European varieties without reduction in sugar yields, while under conditions of exposure to leaf spot it is expected to be in great demand.

Lider (W. R.). **Variety adaptation determined from tests.**—*Sug. Beet Bull.*, v, 4, p. 68, 1941. [Abs. in *Sugar*, xxxvi, 11, pp. 40–41, 1941.]

In connexion with a series of varietal tests on sugar beets carried out by the Spreckels Sugar Company in California from December, 1939 to May, 1940, it is mentioned that in the March plantings where blight [? *Cercospora beticola*: see preceding abstract] was prevalent, U.S. No. 22 showed outstanding resistance, followed by U.S. 23, both slightly superior in this respect to U.S. No. 12, whereas U.S. 15 was almost equally susceptible with Old Type and should consequently be used exclusively for early plantings (1st December to middle or end of January).

Raleigh (G. J.), Lorenz (O. A.), & Sayre (C. B.). **Studies on the control of internal breakdown of table Beets by the use of boron.**—*Bull. Cornell agric. Exp. Sta.* 752, 16 pp., 3 figs., 1941.

Field and greenhouse experiments on the internal breakdown of beets, continued during 1938–40 in New York State [*R.A.M.*, xvii, p. 718], supplied evidence that the disease (stated to be identical with dry rot, internal black spot, and canker) is likely to be more severe and the response to boron less pronounced when high yields accompany unfavourable conditions than when yields are low as a result, possibly, of inadequate fertilization. Under conditions favouring severe breakdown, the application of 50 lb. borax per acre did not entirely eliminate the disease but gave satisfactory commercial control, especially when the crop was harvested immediately after the appearance of the first symptoms. For alkaline soils which have not been heavily fertilized with borax in the past, the application of borax thoroughly mixed with the fertilizer to supply 50 lb. borax per acre before the beets are planted is recommended as a standard practice. The application should be made soon after mixing and preferably a single-strength fertilizer should be used. On more acid soils, 50 lb. borax per acre may be injurious to beets, and it is almost certain to be injurious to boron-sensitive crops, such as beans, on any soil. It is thought advisable for the present to grow boron-tolerant crops such

as cabbage rather than beans on fields fertilized with 50 lb. borax per acre the previous year.

ANTONOVA (Mme S. P.). Антракноз Гороха. [Anthracnose of Peas.]—*Bull. Pl. Prot., Leningr.*, *1940*, 5, pp. 133–136, 1940.

Anthracnose of peas (*Colletotrichum pisi*) was observed on experimental fields of the Omsk Agricultural Institute [West Siberia] during 1938–9, severely attacking up to 39 per cent. and mildly affecting up to 100 per cent. of the harvested pods of some varieties. This is believed to be the first authentic record of the disease from the U.S.S.R., although it was listed by Jaczewski (1937) among those occurring in Russia. The symptoms and cultural characteristics largely correspond to those described from the United States [*R.A.M.*, i, p. 282; xii, p. 355]. Conidial fructifications were observed on spots on the leaves, stems, and pods in the form of small, orange-coloured, roughly circular cushions, 0·5 mm. in diameter, with abundant setae, up to 100 μ long and 9·0 μ thick. Artificial infection of pea seedlings succeeded with difficulty and only in the presence of wounds. Attempts to infect the leaves and stems of mature beans [*Phaseolus vulgaris*] failed, but conidia were formed on bean pods injured prior to infection. The disease was apparently not transmitted by seed. The symptoms caused by *C. pisi* are stated to resemble in most respects those produced by *Ascochyta pisi* and *A.* [*Mycosphaerella*] *pinodes* [ibid., xx, pp. 232–233], the main point of difference being the absence of lesions and discoloration in the seeds of plants affected by the anthracnose fungus.

COSTA (A. S.) & FORSTER (R.). **Duas molestias de virus de Feijoeiro (Phaseolus vulgaris L.).** [Two virus diseases of the French Bean (*Phaseolus vulgaris* L.).]—*Biológico*, vii, 7, pp. 177–182, 5 figs., 1941.

The two virus diseases of French beans (*Phaseolus vulgaris*) most commonly observed at the Santa Elisa Central Experiment Station, São Paulo, Brazil, are stated to be ordinary and dwarf mosaic caused, respectively, by *Phaseolus* viruses 1 and 2, as described by Pierce [*R.A.M.*, xiii, p. 488]. In experiments in 1936 to determine the reaction of some indigenous varieties and lines to ordinary mosaic, Bico de Ouro [Beak of Gold] (No. 242 and line 36–2036) proved to be highly resistant with 0·3 and 0·6 per cent. infection, respectively, while Vanguarda and Mulatinho were very susceptible and susceptible, respectively, with 16·8 and 7·8 per cent. infection, and four selections of Mulatinho contracted the disease in a milder form (1·5 to 3·4 per cent.). The influence of ordinary mosaic on the yield of affected plants was not as marked as in the case of the dwarf form, the average number of pods produced by each plant in a test of 20 ranging from 7 to 33 and the average number of seeds per pod from 1·7 to 4·8 in the case of the former disease, the corresponding figures for the latter in 18 plants being 0 to 12 and 0 to 5, respectively. The Vanguarda variety was the least susceptible to dwarf mosaic (0·3 per cent.), followed by Bico de Ouro No. 242 and New Mulatinho (variety No. 1) with 0·6 and 0·8 per cent., respectively, and Mulatinho the most so with 4·6 per cent. No evidence of seed transmission of ordinary mosaic was obtained, whereas in the case of the dwarf form all six plants of HM. 224–9 raised from infected

seed developed the typical symptoms, though the plants of eight other lines grown from infected seed remained healthy.

KLIMKE (A.). **Untersuchungen über die Corynespora-Krankheit der Gurke und die Resistenz deutscher Gurkensorten.** [Studies on the *Corynespora* disease of the Cucumber and the resistance of German Cucumber varieties.]—*Phytopath. Z.*, xiii, 4, pp. 401–435, 13 figs., 4 diags., 1941.

A tabulated account is given of the writer's recent studies at the Biological Institute, Dahlem, Berlin, on the mode of infection of cucumbers by *Corynespora* [*Cercospora*] *melonis* [*R.A.M.*, xii, p. 578], the influence of certain external factors on the course of the associated leaf blight, the virulence of the strains of the fungus tested, and the reactions to the disease of commercial varieties.

The pathogen was found to enter its host through the stomata and at the junctions of two or three epidermal cells, the appressorium-like elements formed giving rise to hyphae which spread through the tissues, especially those of the spongy parenchyma. Immature stems and petioles did not respond to inoculation with *C. melonis* even through wounds, while the fruits are also susceptible only in the ripe stage, though young ones may be infected by way of the perianth or stigma. The first symptom of the disease, appearing after an incubation period of four days at 25° to 35° C., is a lesion composed of three zones, the central pale to mid-brown, often fissured, the next of a darker colour, with prominent, still darker veins, and the outermost a narrow, dark olive-green ring. The surrounding chlorotic area is at this stage free from actual contamination, and its discoloration must be attributed to an advance action of the fungus; gradually the entire leaf turns yellow. The blight causes stunting of young plants.

Necrosis of the infected tissues falls into three phases, viz., (1) the cells of the chlorotic area are still living, as shown by their turgescence and their capacity for plasmolysis, but the membranes have already sustained damage, which is expressed by an irreversible uptake of the staining reagent (1 in 10,000 Nile blue in these tests); (2) the membranes turn brown and some of the cells contain a brown deposit which stains bluish-green, only a few being still capable of plasmolysis; (3) the cell lumen and the intercellular spaces near the smaller veins are filled with a brown substance, identifiable by its staining reactions as wound gum, the cells themselves having lost their turgescence and their brown, granular contents no longer reacting to staining.

In addition to high mean temperatures, *C. melonis* requires for its development and spread sharp fluctuations, experiments having shown that the lesions expand most rapidly when a maximum day temperature of 33° to 36° is followed by a minimum night temperature of 10° to 12°. The incubation period of the fungus was prolonged from four to five or six days by the daily withdrawal of light from the plants for 15 hours, thus confirming the observation that its pathogenicity is at a low ebb during the dark winter months.

No morphological differences were detected between three isolates of *C. melonis* obtained, respectively, from the mycological service of the Biological Institute (A), the Centraalbureau voor Schimmelcultures,

Baarn, Holland (B), and diseased cucumbers at the Horticultural Research and Experiment Station, Dahlem (C), but the last-named proved to be the most virulent and (B) the least so. In tests with pure cultures of the three isolates from carrot agar on 37 commercial varieties, only the English Butcher's Disease Resister and Spot Resisting gave any evidence of resistance, outdoor cucumbers proving particularly susceptible. There was a marked lack of uniformity in the reactions of samples of a given variety from different sources, and even between lots of the same origin, a phenomenon attributed to the frequency of cross-pollination among cucumbers and the propagation of 'impure' lines. The mode of infection in resistant plants does not differ from that described for susceptible ones, the parasite being merely inhibited from further growth without sustaining any injury.

CHILDS (J. F. L.). **The effect of aluminium on the deposition of copper on Cucumber leaves and on protection against Peronoplasmopara cubensis.**—Abs. in *Phytopathology*, xxxi, 9, p. 860, 1941.

The addition of increasing amounts of aluminium nitrate to copper phosphate and three proprietary cuprous oxide (cuprocide) suspensions enhanced their protective action against *Peronoplasmopara* [*Pseudoperonospora*] *cubensis*, the agent of cucumber downy mildew. Colorimetric analysis indicated that on the leaves of the host the deposition of copper phosphate and cuprocide H–112 (acid suspensions) was decreased in the presence of aluminium nitrate, whereas that of cuprocide H–167 (alkaline) was not affected. It would appear from these data that the increased protective capacity conferred by aluminium nitrate on the fungicides tested is more closely related to an intrinsic property of the compound than to its conversion of the negative charges of the copper-containing preparations into positive ones and the consequent changes in the deposition of the particles on the foliage.

KREUTZER (W. A.). **Host-parasite relationships in pink root of Allium cepa. III. The action of Phoma terrestris on Allium cepa and other hosts.**—*Phytopathology*, xxxi, 10, pp. 907–915, 3 figs., 1941.

Continuing his studies at the Colorado Agricultural Experiment Station on the relations between *Phoma terrestris*, the agent of onion pink root, and its host [*R.A.M.*, xix, p. 4], the author observed the mechanism of invasion by the fungus of Yellow Globe Danvers seedlings (*a*) at the edges of potato dextrose agar cultures of the pathogen, and (*b*) in artificially infested soil. In both cases the fungus formed small, irregular colonies on the root surfaces and invaded the host by means of hyphae showing characteristic constrictions at the point of entry. From the site of primary invasion the hyphae ramified throughout the cortex, both intra- and intercellularly, eventually forming pycnidial primordia in the cortical and epidermal cells. The extensive diffusion of pigment noted by Hansen [ibid., ix, p. 155] was not observed; in fact, the colouring substance was mainly confined to the hyphae. In cases of artificial inoculation, the fungus tended to sweep across the cortex in a hyphal mass, under which conditions the root speedily collapsed. Infection of the promeristematic region of the root tip was never observed. The fungus did not invade the living leaf tissue of the

bulb, but it was consistently present on the dead outer scales of mature bulbs or sets from one to three weeks after planting in infested soil, and was frequently isolated from the diseased material. On white varieties, such as Silverskin and Southport White Globe, the fungal blemishes were pink or purple-red, while on Yellow Globe Danvers or Red Wethersfield they assumed the form of water-soaked areas.

No evidence was obtained that the invasion of onion roots by *P. terrestris* afforded ingress to *Fusarium vasinfectum* var. *zonatum* f. 1, as suggested by Davis and Henderson [ibid., xvii, p. 7], the latter fungus having been experimentally shown to attack mechanically injured bulbs only.

In soil inoculation experiments on a number of crop plants likely to rotate with onions the following proved to be moderately or highly susceptible: Black Amber cane sorghum (*Sorghum vulgare* var. *saccharatum*), Early Fortune millet (*Panicum miliaceum*), Davis Perfect cucumber, Oxheart carrot, and spinach, besides Mountain Danvers and Red Wethersfield onions, while mild root symptoms developed on Edwards peas, Brunker oats, Trebi barley, Komar wheat, Improved Golden Bantam sweet corn and Minnesota 13 dent maize, Hubbard squash, Golden Honeymoon cantaloupe, Extra Early Osage muskmelon, New York Improved eggplant, and Super Snowball cauliflower, in addition to Sweet Spanish onions [ibid., xii, p. 547]. The pathogen was isolated from the roots of all the onion varieties tested, *P. miliaceum*, tomato, carrot, spinach, World Beater chilli, and soy-bean, the two last-named showing no characteristic external symptoms, as well as from the pericarps of germinating caryopses of barley, wheat, and the two maize varieties.

Tompkins (C. M.) & Tucker (C. M.). **Root rot of Pepper and Pumpkin caused by Phytophthora capsici.**—*J. agric. Res.*, lxiii, 7, pp. 417–426, 3 figs., 1941.

A destructive root rot of pepper (*Capsicum annuum* var. *grossum*) and pumpkin (*Cucurbita pepo* var. *condensa*) plants caused by *Phytophthora capsici* [*R.A.M.*, xx, p. 447] is described from the San Joaquin Valley, California. The inception and spread of the disease is favoured by excessive moisture, inadequate soil drainage, and high air temperatures. The disease appears very suddenly at mid-season, and the infected plants usually die promptly. The chief symptoms are wilting of leaves without noticeable change of colour; a blackish-brown discoloration of the stem near the soil with subsequent collapse and lodging of the plant; and a soft, water-soaked, blackish-brown, odourless decay of the roots and underground part of the stem. Inoculation of the soil in pots in the greenhouse with inoculum from cultures on wheat gave successful infection of young pepper and pumpkin plants with incubation periods of from 6 to 14 and from 12 to 21 days, respectively. All varieties of pepper and pumpkin tested in the greenhouse proved to be highly susceptible to the disease. Cross-inoculation of pumpkin with pepper isolates and vice versa gave positive results, all isolates causing damping-off of pepper and pumpkin seedlings in the greenhouse and rotting of pepper and pumpkin fruits in the laboratory. Both isolates were also pathogenic to squash (*C. maxima*), eggplant, and tomato.

MIDDLETON (J. T.). **Crown rot of Rhubarb caused by Pythium spp.**—Abs. in *Phytopathology*, xxxi, 9, p. 863, 1941.

Pythium anandrum [*R.A.M.*, xviii, p. 651], *P. oligandrum* [ibid., x, p. 211], and *P. ultimum* were isolated from rhubarb plants suffering from decay of the roots, crowns, buds, and petioles in the San Francisco and Los Angeles districts of California. Plants with infected roots are usually small and more or less chlorotic and often die. Infection progresses from the soft, water-soaked crowns to the bud scales and thence to the petioles, blighting the young shoots. Petioles pulled from plants with infected bud scales frequently rot in transit, spreading contamination throughout the container. Each of the three species produces identical symptoms independently. All are able to cause damping-off of rhubarb seedlings, *P. ultimum* being the most virulent in inoculation experiments.

JENKINS (W. A.). **An apparently undescribed disease of the Peanut (Arachis hypogaea).**—*Phytopathology*, xxxi, 10, pp. 948–951, 2 figs., 1941.

The leaves of groundnut plants growing on stiff clay soil, severely puddled following a heavy rain, at the Georgia Experiment Station, were observed in September, 1940, to bear on the lower surfaces roughly rectangular, deep brown to nearly black blotches, which appeared when viewed through the upper surface by transmitted light as mosaic patterns interspersed with definite, pin-point, necrotic areas. The petioles and young stems were also involved. Many of the affected plants were more or less chlorotic, stunted, poorly nodulated, and gave low yields, but typical symptoms were found on plants of normal colour. A histological examination of the affected foliage revealed necrosis of the dorsal epidermis and spongy mesophyll; partial discoloration of certain portions of the vascular system; large bodies, staining pale violet to dark brown with cotton blue, in the lower epidermal and mesophyll cells of limited areas; a 'tightly-packed' appearance of the palisade parenchyma and chlorosis of its chloroplasts; and scattered epidermal necrosis, corresponding to the above-mentioned pin-points. The disease has also been reported from the Coastal Plains of Georgia (on sandy soil), Texas, and Virginia. Several branches from affected plants grown in complete nutrient solutions made an entire recovery, indicating that a mineral deficiency may be responsible for the trouble.

COSTA (A. S.). **Uma molestia de virus do Amendoim (Arachis hypogaea L.). A mancha anular.** [A virus disease of the Groundnut (*Arachis hypogaea* L.). Ring spot.]—*Biológico*, vii, 9, pp. 249–251, 2 pl., 1941.

Since 1938–9 groundnuts from the São Paulo (Brazil) Agronomic Institute, planted at the Santa Elisa Central Experiment Station, have been observed to show primary leaf symptoms consisting of yellow, roughly circular lesions with dark red, necrotic dots on their surfaces and sometimes surrounded by a purplish margin, and secondary manifestations characterized by a compact growth composed of small, crinkled leaves, some with a rolled upper surface, and mosaic of the leaflets, the alternating dark green and greenish-yellow areas being disposed either in circular rings or in sinuous lines running more or less

parallel with the secondary veins. Necrosis may develop in some of the new growth and even extend to the petioles and stem. Affected plants cease to grow and their yield is immensely reduced; in very severe cases no crop is produced.

The disease, which was found not to be transmissible by way of the seed, is indubitably caused by a virus and probably conveyed by thrips from infected to healthy plants. It presents points of resemblance with 'vira cabeça' [? of potatoes: *R.A.M.*, xx, p. 502] and *Arachis* virus 1 [rosette]. Observations on the reactions to the virus of 45 groundnut varieties and selections under cultivation at the plant-breeding section of the Central Experiment Station indicated that Rasteiro and I.B.M. 16/4 are immune (0 per cent. infection) and I.B.M. 6/5 highly resistant (2·2), the remainder being more or less susceptible with percentages ranging from 5·1 (Roxo) to 50 (Amendoim Bravo).

Luthra (J. C.), Sattar (A.), & Bedi (K. S.). **Determination of resistance to the blight disease [Mycosphaerella rabiei Kovačevski = Ascochyta rabiei (Pass.) Lab.] in Gram types.**—*Indian J. agric. Sci.*, xi, 2, pp. 249–264, 1941.

Of 392 types and collections of gram [*Cicer arietinum*] tested at the Lyallpur (Punjab) Agricultural College for their reaction to blight (*Mycosphaerella rabiei*) [*R.A.M.*, xviii, p. 86; xx, p. 514], all the Indian material proved susceptible, while of the foreign lines, Pois Chiches Nos. 4732, 199, and 281 (known locally as F8, F9, and F10, respectively), showed a high degree of resistance to the pathogen under varying environmental conditions. F8 is the best yielder of the three, besides possessing other desirable characters, and its seed is being multiplied for distribution among farmers in the blight-affected areas of the province; about 25,000 maunds [918 tons] were expected to have been available in 1940.

Kheswalla (K. F.). **Foot-rot of Gram (Cicer arietinum L.) caused by Operculella padwickii nov. gen. nov. spec.**—*Indian J. agric. Sci.*, xi, 2, pp. 316–318, 3 figs. (1 col.), 1941.

Wilted gram (*Cicer arietinum*) plants from Karnal in the Punjab in 1938–9 and others from the Imperial Agricultural Research Institute, New Delhi (where the writer's studies were conducted) in 1939–40 yielded a very unusual fungus belonging to the Spheropsidales and designated *Operculella padwickii* n.g., n.sp., 85 isolates of which were obtained from eight out of nine varieties of the host, as compared with 111 of *Fusarium* [*R.A.M.*, xxi, p. 1].

The organism, which was grown in pure culture on oatmeal and potato dextrose agar, is characterized by unilocular, discoid to subglobose, erumpent, carbonaceous pycnidia, 270 to 810 μ in diameter, opening with an apical pore or by means of a hinged lid; conidiophores of two types, the shorter unbranched, averaging 83 μ in length, forming a compact layer over the entire inner pycnidial surface, and bearing spores terminally; the longer sparsely branched, sometimes septate, and producing spores on minute sterigmata. The spores are hyaline (yellowish-white in the mass), irregular in shape, continuous, and 7·4 to 16·6 by 5·5 to 11·1 μ.

Diseased plants shrivel from the tip downwards, the leaves becoming chlorotic and finally dropping, while the collar turns dark brown; the roots and rootlets may also be involved. The stem and root tissues were permeated by a broad, granular, inter- and intracellular, septate mycelium, but no fruiting bodies developed on the host either in nature or in inoculation tests. The latter were consistently successful only by the method of soil infestation with cultures of the pathogen from a mixture of soil and maize meal, 14 to 81 per cent. of the plants arising from seeds sown in which contracted the wilt. Immersion of the seed in a spore suspension yielded a small proportion of infected plants.

CONNERS (I. L.). **Twentieth Annual Report of the Canadian Plant Disease Survey, 1940.**—xvi+104 pp., 1 map, 1941. [Mimeographed.]

In this report [cf. *R.A.M.*, xx, p. 101], the author states that during 1940 wheat stem rust (*Puccinia graminis*) did little damage in western Canada owing to the use of resistant varieties, though in a few areas, especially in south-central Saskatchewan, severe damage was caused to late crops of susceptible varieties. In eastern Canada infection was unusually light. Under rust-free conditions, the resistant varieties yielded about as well as the older ones. Oat stem rust and crown rust (*P. coronata*) were in most cases present only in small amounts from Manitoba eastwards.

Wheat root rot (*Helminthosporium sativum* and *Fusarium* spp.) in Manitoba caused an average estimated loss of 16·6 per cent., as compared with 7·4 per cent. in 1939. In Alberta and Saskatchewan the disease was about as prevalent as usual, but infection was less severe.

Wheat kernel smudge [ibid., xvii, p. 448], due chiefly to species of *Alternaria*, was more prevalent than usual in the Prairie Provinces; the condition caused the de-grading of 7·6 per cent. of the cars in Manitoba, 2·4 per cent. in Saskatchewan, and of 2 cars in 5,000 in Alberta.

Stalk and ear rots due to *Nigrospora sphaerica*, *Fusarium moniliforme* [*Gibberella fujikuroi*], *F. graminearum* [*G. saubinetii*], and *Diplodia zeae* were very destructive in the seed maize belt of south-western Ontario.

Lucerne bacterial wilt (*Phytomonas insidiosa*) [*Aplanobacter insidiosum*] was widespread in the irrigated sections of southern Alberta. It was very heavy in the Brooks area, attacking stands under three years of age, and was also severe in all fields of the Grimm variety at the Experiment Station, Summerland, British Columbia. *Phytophthora cactorum* was general on sweet clover [*Melilotus*] in southern Alberta. New extensions and records of forage crop diseases included *Ascochyta imperfecta* [ibid., xviii, p. 11] on lucerne in Quebec, *Leptosphaeria pratensis* [ibid., xix, p. 102] on lucerne and *Melilotus* in Alberta, and *Stemphylium botryosum* [the conidial stage of *Pleospora herbarum*: ibid., xx, p. 306] on lucerne at Agassiz, British Columbia.

Two leaf spots of sugar beet new to Canada were found at Sidney, British Columbia, one due to *Ramularia beticola* [ibid., xiv, p. 548], the other to *Septoria betae* [ibid., x, p. 341]. *Ustilago crameri* [ibid., xviii, p. 174], rare in Canada, was observed on seed of foxtail millet [*Setaria italica*]. The first authentic case of halo blight (*Phytomonas* [*Pseudo-*

monas] *coronafaciens* var. *purpurea*) on brome grass [*Bromus*] and timothy [*Phleum pratense*] was recorded at Morris, Manitoba [cf. ibid., xx, p. 102].

Bacterial ring rot (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: loc. cit.] was found on 89 farms in the important potato-growing district of southern Alberta, though it had been present on only 40 in 1939. The disease also increased in Manitoba, Ontario, and Prince Edward Island, while a decrease was shown in Quebec and New Brunswick.

Phytophthora infestans destroyed at least 20 per cent. of the late potato crop in Ontario, losses being comparable to those sustained in 1928 and 1934. The disease caused some loss elsewhere in eastern Canada, but only in New Brunswick was any considerable damage sustained.

A new strain of *Cladosporium fulvum* made its appearance, to which Vetomold [ibid., xx, p. 437], a new tomato variety immune from strains 1 to 4, was susceptible. Red Currant, a variety of *Lycopersicum pimpinellifolium*, is, however, resistant to the new strain, and varieties of tomatoes possessing this resistance are to be introduced into commercial production.

New records for ornamentals include *Sclerotium tuliparum* [ibid., xix, p. 656] on bulbous iris and *Phytomonas primulae* on *Primula polyantha*, both in British Columbia.

[A French translation of the section of this report dealing with new and noteworthy diseases appears on pp. xi to xiv.]

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lii, 9, pp. 463–466, 483, 5 figs.; 10, pp. 536–539, 4 figs.; 11, pp. 579–581, 3 figs., 1941.

In the first of these notes on plant diseases in New South Wales it is stated that sorghum and broom millet [*Sorghum*] are both affected by kernel smut (*Sphacelotheca sorghi*) [*R.A.M.*, xx, p. 393] and head smut (*Sorosporium reilianum*) [ibid., xviii, p. 517]. The former disease may be readily controlled by seed dusting with copper carbonate, agrosan, or ceresan, at the rate of 2 oz. per bush. Besides being simple, effective, and inexpensive, the treatment also reduces loss from defective germination and seedling blight. Whenever heads infected by the latter disease are found in the field, they should be removed without scattering the spores, and burned. Crop rotation and the systematic burning of old stalks and trash (particularly after harvesting broom millet) also assist in reducing head smut to a minimum.

Mosaic was prevalent in glasshouse tomatoes, and observations showed that in the houses where the disease was widespread the persons handling the crop were heavy smokers. It is recommended that the hands should be thoroughly washed in hot soapy water before starting work in tomato houses, and that workers should refrain from smoking while handling the crop.

New records made in July, 1941, included leaf spot of azalea (*Rhododendron* sp.) caused by *Septoria azaleae* [ibid., xvii, p. 113].

In the second paper, growers in the coastal areas are advised that the first spray application against citrus black spot (*Phoma citricarpa*) [ibid., xix, p. 143], whichever of the two Bordeaux-mixture programmes

is adopted [ibid., xix, p. 69], must be given at three-quarter petal-fall, i.e., when most of the blossoms on the northern side of the trees have shed their petals, but before all the petals have fallen from the southern side.

The first cover spray for the prevention of fruit and leaf rust [*Puccinia pruni-spinosae*: ibid., xix, p. 195] in canning peach varieties on the Murrumbidgee Irrigation Area should be made about the third week in October; it should be followed by a second in mid-December. Bordeaux mixture (1½–1–80) plus ½ gal. white spraying oil should be used. Peach growers in other districts are warned against applying Bordeaux mixture to trees in leaf. The Murrumbidgee Irrigation Area is the only section of New South Wales in which copper materials can be safely applied to peach trees once growth has started.

Snapdragon [*Antirrhinum majus*] downy mildew (*Peronospora antirrhini*) [ibid., xvii, p. 686] first appeared in New South Wales about the middle of 1941.

During August, 1941, diseases recorded locally for the first time included dry rot (*Phoma lingam*) of swede turnip (*Brassica campestris* var. *napobrassica*). The same fungus was previously recorded on turnip (*B. rapa*) [cf. ibid., xvii, p. 298], and it is thought that there have been previous instances on swede turnip.

In the third paper it is stated that during recent years the weather has been so dry in the coastal areas that brown rot [*Sclerotinia fructicola*: ibid., xix, p. 227] has not been a limiting factor in the production of early apricots, but periodical rains in the spring of 1941 seemed likely to favour an epidemic in maturing crops. Growers were, accordingly, advised to pay careful attention to orchard sanitation (particularly to the removal of blighted blossoms, cankered, gummed, or wilted twigs, and dead or shrivelled fruits) and to apply a pre-maturity spray about one week before harvesting. As most of the apricot varieties grown in these 'early' districts are susceptible to 'sulphur shock', Bordeaux mixture (1½–1–80, plus ½ gal. white oil) or copper oxychloride (1 lb. per 160 gals.) is recommended at this stage. Sulphur sprays applied while these varieties are in growth are apt to cause foliage and fruit yellowing and failure of the fruit to develop further.

Under local conditions, spraying against banana leaf spot [*Cercospora musae*: ibid., xx, p. 125] gives the best results in 'good' plantations, but it also pays in many of the Tweed, Brunswick, and Richmond River areas. The profitableness of spraying would be more widely recognized than it is if it were not still possible to find a market for the poor fruits gathered from affected plants. As a rule, only four or five periods of the warm, moist weather necessary for the activity of *C. musae* occur locally each summer, and therefore it will probably be found most economical to spray at intervals of 21 days during the most dangerous period—January and February—even though this increases the number of applications from four (as given hitherto) to six. Plantations so situated that they are subject to wide fluctuations between night and day temperatures in summer, and, therefore, to frequent, prolonged dews, do not respond very satisfactorily to sprays applied at intervals of 28 days. In such plantations, it may prove necessary to spray once a fortnight during January and February, but whether this proves profitable or not will depend on the production rate

per acre. In any case, the first application should be made early in December.

Up to a few years ago the Fulghum oats variety was highly resistant to loose smut (*Ustilago avenae*) and covered smut (*U. levis*) [*U. kolleri*] in New South Wales [ibid., xiv, p. 573], but during the past three seasons it has shown considerable infection by *U. avenae*. This is attributed to the appearance of a new physiologic race of the fungus. The same variety previously behaved in an identical manner in America [ibid., ix, p. 372]. Seed treatment with formalin solution (1 lb. formalin to 40 gals. water) or with agrosan or ceresan dust (2 oz. per bush.) is recommended against both diseases.

Report of the Waite Research Institute, South Australia, 1939–1940.—viii+83 pp., 3 pl., 1941.

On p. 16 of this report [cf. *R.A.M.*, xix, p. 197] it is stated that in further breeding work against wheat flag smut (*Urocystis tritici*) [cf. ibid., xix, p. 169; xx, p. 354] in South Australia, most of the crossbreds had only 0 to 3 per cent. infected plants, as against 64 and 69 per cent. for Free Gallipoli and Federation, respectively. Several strains of Nabawa × Hope, Nabawa × (Riverina × Hope), Nabawa × (Nabawa × Hope), and (Gluyas × Hope) × Nabawa, which are undergoing yield trials, possess resistance to leaf rust (*Puccinia triticina* races 16 and 26), stem rust (*P. graminis tritici* race 34), mildew (*Erysiphe graminis*), and *U. tritici*.

Most crossbreds were susceptible to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*]. Florence, with 12 per cent. infection, and Hope, with 4 per cent., were highly resistant, and certain Nabawa × Hope strains were partially resistant, with 30 to 40 per cent. infection, but all other varieties, including a strain of American Turkey and the durum wheats, Huguenot and Gaza, were very susceptible, with 60 to 80 per cent. bunt.

A study, begun in 1940, of the inheritance of resistance to *E. graminis* in *T*[*riticum*] *vulgare* and 28-chromosome wheats, yielded some evidence indicating a single-factor difference between Sonora (resistant) and Federation (susceptible), with dominance of resistance.

In the section dealing with plant pathology (pp. 32–35) it is stated that the climate in South Australia is probably unfavourable to any extensive development of wheat eyespot lodging (*Cercosporella herpotrichioides*) [ibid., xix, p. 465], and the disease may have been present for some time without attracting attention. There is no reason to suppose that it is of recent introduction.

Five years' observations on an area where, in 1935, wheat was badly affected by take-all [*Ophiobolus graminis*: ibid., xix, p. 522], and which was cropped continuously, showed that in this soil the disease virtually died out after four years, in spite of the continuous cropping. Superphosphate dressings were important in reducing the amount of disease present, their effect being cumulative. Tilth had a variable effect on incidence, sulphate of ammonia no effect, and varietal response was slight, but in some cases significant.

Investigations into rind blemish in oranges, associated with various fungi, including species of *Colletotrichum*, *Septoria*, and *Alternaria*, confirmed the extensive occurrence of so-called 'latent' infection of

apparently sound oranges, and showed that the fruits may be infected quite early in their development on the tree. The degree of infection varies greatly in different districts and seasons. Infection was considerably reduced by spray treatments. A tomato bacterial wilt new to South Australia was ascertained to be caused by an organism resembling *Aplanobacter michiganense*, but no cankering was observed, and the principal region involved was the xylem.

Field observations and inoculation tests suggested that the parasitic ability of *Diplodia pinea* [ibid., xx, p. 340] is only limited.

Many light soils in South Australia show mineral deficiencies. The most important appears to be copper, though in some instances zinc is also important. Boron and manganese deficiencies have also been found. Copper deficiency symptoms were experimentally produced in wheat, oats, rye, peas, Wimmera rye grass [? *Lolium perenne*], *Phalaris*, flax, tomato, subterranean clover, and lucerne grown in nutrient solutions [cf. ibid., xxi, p. 92]. In detailed studies on oats, copper deficiency symptoms developed in all the plants growing in solutions containing 0·01 mg. of copper or less per l., and no ears were produced by any of these plants. The first symptoms appeared in the copper-free cultures about five to six weeks after setting the seed to germinate. With 0·02 mg. of copper per l. the only sign of copper deficiency was decreased grain yield. Symptoms of zinc deficiency in oats developed at concentrations up to 0·02 mg. of zinc per l., while growth increased progressively as the amount of zinc was increased from zero to this amount. In other tests, the yield of grain of oats grown under conditions of molybdenum deficiency [ibid., xx, p. 56] was only one-third that of plants receiving adequate traces of this element, while the grain consisted entirely of empty husks. No experimental evidence was obtained that cobalt is of importance in plant nutrition. The amounts of copper found in whole oat plants growing on normal soils varied over a relatively narrow range and averaged 2·5 mg. per kg. The manganese content was more variable. In another series of water cultures, marsh spot of peas [ibid., xix, p. 323] was reproduced by controlling the amount of manganese.

In pot experiments with soil from McLaren Flat, where prune trees show 'little leaf' disease, the growing of indicator plants (oats, broad beans, sunflowers, and turnips) showed clearly deficiencies in boron and manganese. In field tests, boron deficiency was confirmed with broad beans.

At Robe, where lucerne gave satisfactory yields with the assistance of copper dressings, results were much improved by the addition of zinc [ibid., xxi, p. 92]. In experimental areas where pasture legumes had failed even with heavy dressings of copper, remarkable growth of barrel medick [*Medicago* sp.] resulted when both zinc and copper were applied. The resistance to copper deficiency of Rotenburger black oats was confirmed.

WIEHE (P. O.). **Division of plant pathology.**—*Rep. Dep. Agric. Mauritius, 1940*, pp. 11–13, 1941.

In this report [cf. *R.A.M.*, xx, p. 291] on plant disease work in Mauritius in 1940 it is stated that towards the end of the year several

cases of red rot (*Colletotrichum falcatum*) of sugar-cane were observed on the popular new seedling M. 134/32. The available evidence indicates that canes planted early in the season are more susceptible than those planted later. The disease is widespread, particularly in southern areas, but the percentage infection is small.

Tobacco black shank [*Phytophthora parasitica* var. *nicotianae*: ibid., xix, p. 261] was prevalent in fields and nurseries early in the season, particularly in the vicinity of the Black River. The number of plantations affected in the entire island amounted to 13 per cent. of the total, as against 25 per cent. in 1939.

Investigations on the control and spread of the wilt of *Calophyllum inophyllum* var. *tacamaha* caused by a species of *Haplographium* [ibid., xx, p. 291] were continued.

New records included *Corticium salmonicolor* on apple, *Cassia*, and poplar, foot rot of *Dendrobium* spp., due to a species of *Pythium*, mosaic of lily (*Lilium candidum*), and dahlia leaf spot (*Entyloma dahliae*).

Botany.—*Rep. Ga Exp. Sta., 1940–41*, pp. 102–107, 1941.

The following are among the items of interest in this report [cf. *R.A.M.*, xix, p. 450], besides those already noticed from other sources. In connexion with a project for the development of resistance in [chilli] pepper to *Sclerotium rolfsii* [ibid., xviii, p. 80], three selected strains of the Perfection variety were set in the field in three-row blocks with an unselected (control) strain in the centre row of each. The inoculation of each plant with a culture of the pathogen resulted in the development of 100 per cent. infection. Six weeks later all the unselected plants and all those of one selected lot were dead, while 10 per cent. of the other two selected lots had recovered and were making normal growth. The eight best plants from these two lots were self-pollinated and seed produced for further trials.

Tests of dusting materials for the control of groundnut leaf spot [*Cercospora arachidicola* and *C. personata*] are still in progress [ibid., xix, p. 450]; two copper-containing preparations gave promising results in preliminary trials. The average increase in yield from three applications of sulphur dust at fortnightly intervals in various localities of the State amounted in 1940 to 301·1 lb. per acre, the corresponding figures for 1937, 1938, and 1939 being 263·5, 343·4, and 410·1 lb., respectively, and the average for the entire four-year period covered by the experiments 329·5 lb.

The results of greenhouse and field tests have shown that tomato seeds infected by the agent of *Macrosporium* blight and stem canker [*Alternaria solani*: loc. cit.] become free of viable spores 11 to 12 months after harvest, provided no subsequent attack is made, so that the normal second-season planting about 20 months from the date of the first harvest may be regarded as safe from this point of view. Good control of the fungus was obtained by dusting the seed with new improved ceresan or new improved samesan jr., leaving the seed covered for at least a day.

None of the 433 different lots of seed of Austrian Winter and other field peas tested during the past five years for their reaction to leaf

spot and black stem (*Mycosphaerella pinodes* and *Ascochyta pinodella*), leaf blotch (*Septoria pisi*), powdery mildew (*Erysiphe polygoni*), and root rot (largely *Aphanomyces euteiches*) [ibid., xx, p. 211] showed a higher degree of resistance to the diseases in question than Austrian Winter, and most were much more susceptible, the same being true of the progeny of 280 crosses between the best plants of the various lots.

Plant pathology and physiology.—*Rep. Tex. agric. Exp. Sta., 1940*, pp. 83–91, 1941.

This report [cf. *R.A.M.*, xx, p. 195] contains, *inter alia*, the following items of interest. In further work by W. N. Ezekiel on cotton root rot, a strain of *Phymatotrichum omnivorum* kept in culture for 11 years has retained its original characteristics, including abundant production of sclerotia. The disease was observed for the first time (by W. N. Ezekiel and C. H. Rogers) on young plants of *Albizzia julibrissin* and *Prunus virens*. Studies by L. M. Blank [cf. ibid., xx, p. 403] showed that nitrogenous fertilizers significantly reduced the incidence of the disease on four early and four late cotton varieties and gave highly significant increases in yield. Phosphate fertilizers exercised no significant effect when applied to Houston black clay, but on less calcareous soils significantly increased both percentage disease and yield. When soil sulphur was applied in the furrow at the rate of 2,000 lb. per acre on infested fields in November and March, no control resulted but similar applications of a mixture of soil sulphur and manure (1 to 3) in March resulted in a slight reduction in root rot damage.

Investigations by P. J. Talley and L. M. Blank showed that the utilization of nitrate nitrogen by *P. omnivorum* [ibid., xxi, p. 75] sets up a drift towards a more alkaline reaction and does not, as a rule, retard growth. It was demonstrated that ammonium nitrogen and nitrate nitrogen are essentially of equal value in the nutrition of *P. omnivorum* when a favourable P_H is maintained.

A. L. Harrison states that, as in previous years, wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*) was one of the most serious diseases of tomato during 1940 in the Yoakum-Hallettsville area of Texas. In several fields even the wilt-resistant Marglobe variety showed 90 to 100 per cent. infection. The severity of the disease was not affected by varying fertilizer dressings. In tests with insoluble copper materials on plants free from leaf diseases Tennessee No. 34, tribasic copper sulphate, copper hydro 40, basic copper sulphate, and cuprocide gave yields comparable to those of the controls, whereas Bordeaux mixture (4–4–50) appreciably reduced yields.

G. E. Altstatt found that 5 to 15 drops of benzol, carbon bisulphide, carbon tetrachloride, formaldehyde, and toluol, placed so that the liquid did not touch the sclerotia, were lethal to *Sclerotium rolfsii* (in stoppered test-tubes) after 17 hours. One drop and three drops of chloropicrin were lethal after 2½ hours and 30 minutes, respectively. When the sclerotia were exposed to confined vapours from measured quantities of chloropicrin, up to 3 c.c. per l., viability was reduced, though some sclerotia germinated after 25 hours' exposure. Phenyl mercury nitrate (phe-mer-nite) diluted with water (1 in 10,000) was lethal to the sclerotia after immersions of 60 seconds. An aqueous

solution of 1 in 10,000 of sodium ethyl mercury thiosalicylate (merthiolate) reduced viability from 100 to 15 per cent. in three minutes, while five minutes' immersion in a 1 in 1,000 aqueous solution was lethal.

On p. 147 of this report, E. W. Lyle states that sulphur-copper mixtures gave better control of rose black spot [*Diplocarpon rosae*: ibid., xix, pp. 540, 656] than plain sulphur. Satisfactory control again resulted when fungicidal applications were deferred until symptoms developed. With 18 applications of 90 per cent. sulphur plus 10 per cent. cuprocide GA dust mixture, infection was reduced in a planting of 164 hybrid tea roses of different varieties from an average of four infected leaflets per plant on 16th April to 1·1 on 20th October.

E. C. Tullis (p. 163) states that the commonest rice diseases were *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], *Piricularia oryzae*, *Cercospora oryzae* (rotten neck), and *Tilletia horrida* (kernel smut) [cf. ibid., xx, p. 423]. *O. oryzinus* [loc. cit.] was also found on rice at the Experiment Station; it has not yet been observed in commercial rice fields in Texas. At the Station, leaf spot due to *C. oryzae* was less severe on plants from sowings made on 10th June than on plants from sowings made on 20th March.

C. E. Minarik states that in field experiments fertilization with sodium nitrate and ammonium sulphate failed to induce 'straighthead' in rice [ibid., xx, p. 222].

When Early Prolific rice was grown in gravel culture and nutrient solutions containing all possible concentrations of magnesium and calcium were applied to the surface of the gravel, the number of plants with 'white tip' [ibid., xix, p. 493] decreased with increasing concentrations of calcium, whatever the magnesium content of the solution. Calcium toxicity symptoms were produced by 250 p.p.m. of calcium with concentrations of magnesium of 5 p.p.m. and under. When Blue Rose and Early Prolific rice were grown in solution culture with low calcium and varying magnesium concentrations, white tip severity increased with increasing magnesium concentrations.

On p. 245 G. H. Godfrey states that at least four types of citrus gummosis are present in the Lower Rio Grande Valley: (1) a physiological form, not very injurious; (2) a mild form due to *Diplodia natalensis*; (3) an active, foaming type caused by sap fermenting organisms, infectious and transmissible, but not penetrating beyond the cambium layer and not spreading extensively; and (4) an internal wood rot caused by an undetermined, actively parasitic sapwood-invading fungus, which spreads in long, broad streaks into the wood of the trunk and branches, the advancing edge of the infected area having a characteristic pink colour. Type 2 was readily controlled by removing protruding wood to expedite healing-over of the wound, and the application of a wound dressing. Type 3 was rapidly and permanently arrested by cutting the bark to expose the discoloured cambium, and applying a disinfectant and a wound dressing. One tree affected by type 4 was apparently cured by removing all discoloured wood (with a $\frac{1}{4}$ in. safety margin), and applying carbolineum followed by 50–50 asphaltum-carbolineum plus 2 per cent. phenol.

S. S. Ivanoff (p. 273) states that selections of spinach plants for resistance to white rust (*Albugo* [*Cystopus*] *occidentalis*) [ibid., xix, p. 4]

are being made. The disease is so severe in the Winter Garden area that it may seriously threaten the existence of the spinach-growing industry. Hundreds of acres have had to be left uncut owing to infection. Secondary spread occurs by means of irrigation flood water. Circumstantial evidence suggests that the spores may be borne by the wind from diseased to healthy fields several miles away. Abundant infection is present in fields planted to spinach for the first time. The incubation period is about 12 days at about 70° F. and relative humidity of about 80 per cent. The sporangia germinate in free water in under 24 hours at 70°.

Guarch (A. M.). **Comunicaciones fitopatológicas.** [Phytopathological notes.]—Reprinted from *Rev. Fac. Agron. Univ., Montevideo, 1941*, 23, 12 pp., 5 figs., 1941.

Two years previously to the time of writing, *Scolecotrichum graminis* [*R.A.M.*, xviii, p. 587] and its variety *brachypoda* were widespread in Uruguay, the former on *Dactylis glomerata* and the latter on rye and *Bromus unioloides*. The variety is described by Spegazzini in 'Micetes Argentinenses' as differing from the type in the freedom from constriction at the single conidial septum. The conidia in the author's material were light olivaceous, smooth, fusoid, clavate, 32 to 34·5 by 10 to 12·5 μ, and were borne on grey-olivaceous, fasciculate, erect conidiophores, 37 by 6·5 μ. The lesions produced by *S. graminis* var. *brachypoda* on rye leaves measured 3 to 8 cm. by 2 mm. and caused a pale grey or whitish discoloration of the foliar tissue. The conidia of *S. graminis* proper measured 33·3 by 9·9 μ and were constricted at the septum, the conidiophores being 93 μ in length.

Cercospora medicaginis, the agent of a chestnut, yellow- or whitish-bordered leaf spot of spotted bur clover (*Medicago arabica*) [cf. ibid., xviii, p. 397], was observed, for the first time in Uruguay, at the University of Montevideo in 1938, and has since been encountered in several departments of the interior, where the host is of considerable importance as a forage crop. The pathogen has been shown by E. F. Hopkins (*Phytopathology*, xi, pp. 311–318, 1921) to be perpetuated from one year to the next by means of the seed, local samples of which also bore dark spots on the surface.

Puccinia anomala was detected in the teleuto stage on a new host for Uruguay, *Hordeum murinum* subsp. *leporinum*, in the environs of Montevideo, where intensive infection is favoured by the extreme humidity of the climate.

P. arachidis [*R.A.M.*, xix, p. 261], first observed on groundnut in Paraguay by Spegazzini, has been found in Uruguay (in the teleuto stage only) on a native species, *Arachis marginata*, in company with *Ascochyta* sp., on the Brazilian frontier. The same rust was collected in 1936 on various species of *Arachis* by A. Archer in Brazil (also close to the frontier).

Helminthosporium ravenelii is prevalent throughout Uruguay on *Sporobolus berteroanus* [ibid., x, p. 463], and has also been reported from Australia, the United States, Brazil, and the Argentine Republic.

Apples are affected by *Physalospora malorum* [*P. obtusa*] and soft scald, the latter observed for the first time on stored Jonathans.

For the past two years, *Septoria gladioli* has occurred in a destructive form in the University gladiolus plantings, where the pycnidial stage of the fungus on the leaves has been effectively held in check by spraying with 1 to 1·5 per cent. Bordeaux mixture. In the field, however, it is advisable to practise crop rotation and to disinfect the corms by two hours' immersion in 0·25 per cent. uspulun [ibid., xx, p. 20].

Pestalozzia molleriana Thüm. attacks the leaves of *Eucalyptus obliqua*, forming oblong or circular, pale chestnut spots, 1 to 2 cm. in diameter, with red wine-coloured margins; the fungus, which is characterized by quadriseptate, fusiform spores, 22 by 6 μ, the three median cells dark olivaceous and the basal and apical ones hyaline, was found to be causing considerable damage to young trees at the University in 1940.

Riker (A. J.), Lyneis (Mary M.), & Locke (S. B.). **Comparative physiology of crown gall, attenuated crown gall, radiobacter, and hairy root bacteria.**—*Phytopathology*, xxxi, 11, pp. 964–977, 1 fig., 2 graphs, 1941.

In the writers' comparative studies at the Wisconsin Agricultural Experiment Station on the physiological characters of one pathogenic and one attenuated strain of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xx, p. 248], *Bacillus* [*Bact.*] *radiobacter*, and *P.* [*Bact.*] *rhizogenes*, all these organisms except the last-named, which is unable to develop on inorganic sources of nitrogen, behaved similarly to one another in respect of their utilization of various sources of nitrogen and carbon, and carbon dioxide and hydrogen sulphide production, the temperature at which the pathogenic strain of *Bact. tumefaciens* was incubated, i.e., above or below the critical point for gall formation on the tomato (28° to 30° C.), making no difference. *Bact. rhizogenes*, unlike *Bact. tumefaciens*, evolved acid from glucose. The results of serological experiments suggest that pathogenicity in crown gall is independent of any factor associated with agglutinin. Above and below the critical temperature, minor fluctuations in the osmotic pressure of tomato extract were produced by both the virulent and attenuated strains of *Bact. tumefaciens*, and in a sugar medium both lowered the osmotic pressure. Temperatures above and below the critical point likewise permitted good growth of *Bact. tumefaciens* in inoculated tomato tissue, but no galls were formed either on this host, *Sedum*, or *Bryophyllum* above 28°, though they developed at 31° on tobacco, *Nicotiana glutinosa*, and a hybrid between these two species.

Ark (P. A.). **Chemical eradication of crown gall on Almond trees.**—*Phytopathology*, xxxi, 10, pp. 956–957, 1941.

Of the many chemicals tested during the past three years for the control of crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) on almond trees in the San Joaquin Valley, California, where the destructive character of the disease is a limiting factor in production (also of peaches), elgetol (sodium-dinitro-cresol), iodine, and clove oil gave the most effective results. The elgetol (20 vols.) was diluted with methanol (methyl alcohol) (80 vols.) and the mixture well shaken before painting on the clean gall and about ½ to 1 in. of the healthy bark. Two reliable

iodine formulae consist of: A, 50 parts methanol (methyl alcohol), 25 parts each glacial acetic acid and glycerine, and 10 parts metallic iodine; and B, 100 parts methanol, 15 parts acetic acid, and 12 parts metallic iodine. These solutions are intended for use on whole galls, and if applied to a scarified surface should be diluted with methanol five and six times, respectively. Clove oil and acetic acid (1 part each) and methanol (2) also gave very good control, but the expense of the first-named ingredient is likely to preclude its use on a large scale. Elgetol, on the other hand, is both cheap and effective: 55 galls treated from July to December, 1939, were found to be dead in May, 1940, and by the following September there had been no recurrence of infection.

Brett (C. C.) & Dillon Weston (W. A. R.). **Seed disinfection IV. Loss of vitality during storage of grain treated with organo-mercury seed disinfectants.**—*J. agric. Sci.*, xxxi, 4, pp. 500–517, 1 pl., 1941.

In an introductory paragraph the authors state that the disinfection of cereal seed-grain with organo-mercury dressings has become an established practice in recent years in England and Wales, as many as 260 centres being estimated to have existed in 1938, where seed treated by the seed merchants could be obtained, and the number of centres has undoubtedly increased since then. As the seed-grain may be held some months after treatment, in some cases with injury to germination, an inquiry was made into the storage conditions necessary to ensure the minimum loss of vitality.

The results of seven experiments, in which the seed-grain of wheat, oats, and barley was treated with proprietary organic mercury dusts at rates of from 2 to 10 oz. per bush. and then stored in envelopes or jute bags, confirmed previous preliminary conclusions [cf. *R.A.M.*, xix, p. 521] that seed of high initial germination, average moisture content, sound physical condition, dusted as recommended and stored under satisfactory conditions, does not lose vitality to any greater extent than untreated seed during at least one year's storage or, in some cases, longer. The application of overdoses induced a more pronounced loss of germination, especially after a year's storage. High moisture content of the seed and conditions of relatively high humidity and of fluctuating temperature during storage caused rapid loss of germination in both treated and untreated seed-grain. The loss of germination was observed to be more rapid and the phytocidal effect of the disinfectant more pronounced in wheat than in oats, and in barley least of all. This is tentatively explained by the fact that in threshed wheat the caryopsis is free from the paleae, in oats it is free from, but more or less enveloped by, the paleae, whereas in barley it is firmly united with the enclosing paleae. Storage of treated wheat seed-grain in closed containers resulted in very rapid loss of germination, whereas similarly stored untreated grain retained its vitality for well over a year. The maximum amount which could be held by well-conditioned grain varied with the different proprietary dusts. Superficially moist seed-grain retained dust at rates much in excess of those recommended and the overdoses led to retardation and reduction of germination. In addition, it is pointed out that mixing is difficult

with moist seed, and, as a result, the distribution of dust may not be even, too much dust clinging to some seeds which may fail to germinate.

Loegering (W. Q.). **A satisfactory medium for germination of uredio-spores of Puccinia graminis tritici.**—*Phytopathology*, xxxi, 10, pp. 952–953, 1941.

Particulars are given of a rapid and reliable method developed at the Federal Rust Laboratory, University Farm, St. Paul, Minnesota, for the germination of the uredospores of *Puccinia graminis tritici*. The variable results commonly obtained with the wheat rust being attributed to the use of water as a germinating medium, trials were carried out with several kinds of solid substrata, of which 1 per cent. water agar proved to be the most suitable. Ten c.c. of this substance is poured into a Syracuse dish and left to harden; then the spores are mixed in a drop or two of distilled water on a hollow-ground glass slide, and one or two loopfuls of the resultant suspension transferred to the centre of the agar medium. The dishes should be left uncovered as sufficient moisture is available for germination, which may be observed after two to three hours at room temperature. Strikingly consistent results were secured by means of this technique, the average germination being 95 per cent. Using this method, six-weeks-old uredospores showed 5 per cent. germination, whereas no sign of life could be detected in plain water.

Johnson (T.) & Newton (Margaret). **The effect of high temperature on the stem rust resistance of Wheat varieties.**—*Canad. J. Res.*, Sect. C, xix, 11, pp. 438–445, 1 pl., 1941.

Eighteen wheat varieties resistant to stem rust (*Puccinia graminis tritici*) were tested under greenhouse conditions for their resistance to physiologic races 56, 29, and 15 at a constant low temperature of about 60° F., a constant high temperature of about 80°, and at an intermediate temperature fluctuating daily from 50° to 55° at night to 70° to 85° at noon.

At the low and at the intermediate temperature some of the varieties remained immune, while others were highly or moderately resistant. At the high temperature the following were immune or highly resistant, viz., Bokveld, Iumillo, Gaza, Red Egyptian, and N.A. 95 Egypt, while Marquillo × Waratah, Hope, Hochzucht, Minor, Bobin Gaza Bobin, and Federation × Acme were moderately resistant, and Kenya, R.L. 1373, Syria, McMurachy, Sweden, Rhodesian, Falberg, and Eureka were moderately or completely susceptible. In the field the last-named group cannot be expected to display high resistance in regions of high temperature during the rust infection period, and in fact McMurachy and Kenya are known to be less resistant at St. Paul, Minnesota, and Manhattan, Kansas, than at Winnipeg, the mean temperatures for July from 1932 to 1940 being 76·7°, 84·2° (at Topeka, 50 miles from Manhattan), and 69·7° F., respectively. According to Watson [*R.A.M.*, xx, p. 522], certain Kenya wheats were less resistant at St. Paul in 1940 than usual, and the explanation of this behaviour may lie in the high temperature (81°) there during the last 15 days of July.

VALLEGA (J.). **Razas fisiológicas de 'Puccinia triticina' procedentes de Ipanema, San Pablo, Brazil.** [Physiologic races of *Puccinia triticina* originating at Ipanema, São Paulo, Brazil.]—*Rev. argent. Agron.*, viii, 1, pp. 57–59, 1941. [English summary.]

Three distinct physiologic races of *Puccinia triticina* were isolated at the Phytotechnical Institute, Santa Catalina, from samples of wheat from São Paulo, Brazil [*R.A.M.*, xi, p. 359], viz., 19, 64, and 105, of which the two latter are well known in the Argentine [ibid., xiii, p. 619; xx, p. 9], whereas the first named has not hitherto been reported from South America. Race 19 occurred on the Litoral and Klein 32 and 33 varieties, 64 on Centenario, Riosulina, Litoral, Porvenir, Klein 32, and 38 M.A., and 105 on Klein 33 only.

BAMBERG (R. H.). **Fall-sown spring Wheat susceptible to dwarf bunt.**—*Phytopathology*, xxxi, 10, pp. 951–952, 1941.

In 1940, winter wheat in the northern part of the Gallatin Valley, near Bozeman, Montana, was severely attacked by dwarf bunt (*Tilletia tritici*) [*T. caries*: *R.A.M.*, xiv, p. 350; xx, p. 518], a few fields showing 35 per cent. infection, with areas about ½ acre in extent in which over 90 per cent. of the heads were smutted. Infection was most severe on plants grown from seed treated with copper carbonate or new improved ceresan, the failure of which to control the disease points to the use of resistant varieties as a more reliable method. Spring-sown wheat appears to be immune from dwarf bunt under natural conditions. In the autumn of 1939, bunt-free seed of six spring and 75 winter varieties was sown in parts of two fields in which the disease had occurred in the previous crop, and in comparative counts at the end of the winter the average percentages of infection in the spring varieties in three replications were as follows: Pilot 4, Marquis and Ceres 18, Reward 22, Thatcher 24, and Reliance 29, the corresponding figures for six winter ones being 7 for Turkey, 11 for Yogo, 17 for Hybrid 128, 23 for Montana 36, 28 for Karmont, and 41 for Kharkof. It is apparent from these data that the normal resistance of spring wheats to dwarf bunt is not necessarily maintained under autumn sowing conditions.

GARRETT (S. D.). **Soil conditions and the take-all disease of Wheat. VII. Survival of Ophiobolus graminis on the roots of different grasses.**—*Ann. appl. Biol.*, xxviii, 4, pp. 325–332, 1941.

In continued studies on the take-all disease of wheat (*Ophiobolus graminis*) [*R.A.M.*, xx, p. 250], 16 species of grasses were inoculated with the take-all organism and their roots examined under the binocular dissecting microscope for runner hyphae and discolouring disease lesions. Some species were found susceptible and others fairly resistant, while yet other species were difficult to classify in either category. In a different test, the seed of these grass species was sown in a light-textured soil in wooden boxes over a minimal amount of inoculum, the grass tops cut off two months later, and test wheat seedlings planted in the inverted sods to be examined at approximately monthly intervals. The fungus was found to survive in all 16 species to some extent compared with a negligible survival in fallow soil or under clover, but there were notable differences in its longevity under different grasses. The

resistance of *Phleum pratense* was confirmed, and for use on heavily infected land seeds mixtures of this grass and *Avena elatior* [*Arrhenatherum avenaceum*] in place of *Lolium* spp. are suggested.

Walker (A. G.). **The colonization of buried Wheat straw by soil fungi, with special reference to Fusarium culmorum.**—*Ann. appl. Biol.*, xxviii, 4, pp. 333–350, 11 graphs, 1941.

With the object of studying the colonization by fungi of wheat remains in the soil [*R.A.M.*, xix, p. 11], 1 in. lengths of sterilized straw were buried in the experimental soils in 3½ in. pots, incubated at 16° to 20° C., and after requisite periods washed out of the soil, surface-sterilized with mercuric chloride or other disinfectant, and plated out on acidified potato dextrose agar with a P_H value of 5·0. Various groups of organisms, of which *Fusarium culmorum* and *Penicillium* spp. were numerically the most important (at least during the first five months of incubation in the soil), appeared generally to be present in the decomposing straw, but the method of surface sterilization employed apparently decided which organism produced a colony on the isolation plate. When mild sterilizing agents, such as calcium hypochlorite, were used, *Penicillium* spp. were crowded out by the vigorous growth of *F. culmorum*, which grew best of all from straw merely washed in sterile water. On the other hand, *F. culmorum* showed little resistance to the more drastic sterilizing agents such as mercuric chloride and silver nitrate, of which *Penicillium* spp. were very tolerant and after longer periods of treatment remained often the only organisms developing on the plates. The saprophytic isolates of *F. culmorum* from buried wheat straw proved to be just as pathogenic to wheat seedlings as those isolated from diseased plants. It is pointed out that straw invaded by *F. culmorum* as a saprophyte represents potential centres of infection as well as a means of perpetuation of the organism in the soil.

Nicolaisen (W.) & Leitzke (B.). **Gefässversuche über die Eignung verschiedener Produkte der Kupferindustrie zur Bekämpfung der Heidemoorkrankheit (Urbarmachungskrankheit).** [Pot experiments on the adaptability of various products of the copper industry to the control of the heath marsh disease (reclamation disease).]—*Pflanzenbau*, xvii, pp. 263–293, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 10, p. 1315, 1941.]

In pot experiments at the Institute of Fodder Cultivation, Kiel, the effect of various copper products on oats, lupins, and mustard was compared with that of copper sulphate in the control of reclamation disease [*R.A.M.*, xxi, p. 11]. Satisfactory results were obtained with slag from the North German Refinery and waste slag from the Duisburg Copper Works, whereas round oven slag was less effective, presumably owing to its insufficient degree of fineness. Besides the copper content of the residues, the nature of the compounds involved plays an important part in their utility for the purpose under discussion. The outcome of most of these tests was encouraging.

Hynes (H. J.). **The artificial production of ergot.**—*Pharm. J.*, cxlvii (4th Ser., xciii), 4072, p. 172, 1941.

Following representations from the British Government for supplies

of ergot [*Claviceps purpurea*], cultures were prepared by the Department of Agriculture, New South Wales, and despatched to 28 growers in widely separated parts of the State. Tests were made to find the most suitable means of propagating the fungus in bulk [*R.A.M.*, xxi, p. 70], including the use of rye grain, oats, and rye plus oats, in quart bottles (300 ml. grain per bottle), to which different quantities of water were added, with and without calcium carbonate. Pre-soaking was also tested. All the bottles were plugged with cotton wool, autoclaved for one hour at 15 lb., and inoculated from agar cultures by needle transfers. They were then vigorously pounded on a rubber cork to ensure adequate mixing of the spores with the grain. After incubation at 23° to 25° C. for three to four weeks without further shaking, it became evident that the best fungal growth had occurred on rye to which 300 ml. water had been added before sterilization. The addition of calcium carbonate made no difference. When the fungus-permeated medium was removed, shaken in water, and the liquid strained through a knapsack spray sieve (30 meshes to the linear inch), the suspension teemed with conidia. When the cultures were required, the material was removed from the bottles and despatched in cardboard cartons. It had to be used promptly, as when stored for a week or so it became contaminated with common moulds.

Growers were directed to store the cartons in a cool place and inoculate when the rye was breaking into flower. One carton of culture (1 qt.) used with 80 to 100 gals. water sufficed for one acre of rye. Some 200 acres were treated; yields of ergot were low (½ to 20 lb. per acre) owing to dry weather. Spraying in misty weather was found to be advantageous. Growers were informed that mature ergots could be collected by hand at grain maturity or with the grain at harvesting and threshing, subsequently being floated off in 20 per cent. brine solution, rinsed, and dried.

In a test at the Biological Glasshouses in which black winter rye was sown in a plot of 316 sq. ft. in May, 1940, and inoculated four times at intervals of 10 days, beginning when the first spikelets flowered, the yield amounted to 14 oz., representing 121⅓ lb. per acre. Preliminary pot tests in the glasshouse indicated that the best time for inoculation was during the early flowering period.

It is concluded that ergots of high quality can be produced artificially in New South Wales, but the main limiting factor to success on a commercial scale is the uncertainty of the weather conditions when the rye comes into flower. Only in the cooler, moister localities can the project be considered.

[The information given in this paper also appears in *Agric. Gaz. N.S.W.*, lii, 11, pp. 571–573, 581, 4 figs., 1941.]

Melville (R.). **Ergot cultivation.**—*Pharm. J.*, cxlvii (4th Ser. xciii), 4073, p. 178, 1941.

With reference to Hynes's investigations carried out in New South Wales on the commercial production of ergot [*Claviceps purpurea*: see preceding abstract], the author points out that, for the project to be successful in Britain, cool, humid conditions during the flowering period of the rye are also necessary. The culture of the conidial stage of the

fungus on rye grains in quart bottles appears to be the most practicable method of providing inoculum. Large stocks of such cultures can be prepared and kept in cold storage, the conidia retaining their vitality for long periods at 0° to 4° C. Inoculations are best made in the early flowering stage, when a large proportion of the glumes are open, and the anthers are exserted. If more than one is made, they should be carried out at two-day intervals. Other biological features of the rye plant should be turned to account. Thus, in some varieties many of the flowers in a spike open simultaneously, while in others flowering is successional and is spread over a longer period; stroking or brushing the ears induces the glumes to open.

Cultures should be started from individual ergots with a rich alkaloid content, which can be assayed micro-chemically [cf. *R.A.M.*, xix, p. 273]. The injection inoculation method deserves a trial. Direct injection of spores into the young ears before the glumes open would probably give more uniform infection under differing climatic conditions than does spraying. Ergot cultivation should be attempted only where the climate is sufficiently humid.

Levitt (E. C.) & Nicholson (R. I.). **Severe manganese deficiency of Citrus.**—*Agric. Gaz. N.S.W.*, lii, 9, pp. 477–479, 4 figs., 1941.

In 1938, a late Valencia orange tree growing at Glenorie, New South Wales, was observed to show severe symptoms of manganese deficiency [*R.A.M.*, xix, pp. 338, 644]. Stunted, small, and bushy, it tended to produce occasional strong S-shaped growths. The foliage was a yellow greenish-grey. No gumming was present. Many short twigs were produced, and defoliated twigs were common. The leaves were mostly small, rounded, and dorsally curved. On mature leaves the veins on the dorsal surface were raised. Abscission of the immature leaves frequently took place progressively from the base of the new growth, occasionally causing complete defoliation, but the terminal three or four leaves generally remained attached, giving the shoots a tufted appearance. During the first four years after planting, the tree failed to crop, though blossom production was profuse. The manganese content of sample leaves was found to be only 4·4 p.p.m. dry weight, as against 10·7 p.p.m. for the leaves of adjacent trees showing the usual manganese deficiency mottle.

On 16th January and 8th October, 1940, half the tree was sprayed with a mixture made up of 4 lb. manganese sulphate, 2 lb. hydrated lime, and 80 gals. water, plus agral II spreader. The treated side grew normally and set a heavy crop, while the untreated half bore a light crop of small fruits. Analyses showed the sprayed leaves to have a manganese content of 81·9 p.p.m., as against 3·2 p.p.m. for the unsprayed.

The extreme symptoms shown by this tree are attributed to the alkaline effect on the soil of ashes resulting from the burning of orange trees on the same site two years before the tree was planted.

De Fluiter (H. J.). **Over het voorkomen van de grijze Dadapschimmel op Koffie.** [On the occurrence of the grey Dadap fungus on Coffee.] —*Bergcultures*, xv, 42, p. 1441, 1 fig., 1941.

At the Besoeki (Java) Experiment Station, *Septobasidium bogoriense*

[*R.A.M.*, x, p. 557], the so-called 'grey dadap fungus', has been found parasitizing scale insects (*Ischnaspis longirostris*) and green aphids (*Coccus viride*) on coffee branches and 'cherries', almost completely investing them with a grey crust.

Mitchell (R. B.), Adams (J. E.), & Thom (C.). **Microbial responses to organic amendments in Houston black clay.**—*J. agric. Res.*, lxiii, 9, pp. 527–534, 7 graphs, 1941.

As a background for studies on the control of cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xx, p. 301] investigations were undertaken on the soil microbiology of Houston black clay, the soil type chiefly infected with the cotton root-rot organism in Texas. It was found that the highest microbial activity occurred during a period beginning in March and ending in early June. The temperatures ranged above 70° F. from March to November and from 80° to 90° from June to October, while from early December to February they remained below those required for active microbial multiplication. The highest counts for bacteria, fungi, and Actinomycetes were made on soils receiving organic residues [ibid., xvi, p. 672].

Mitchell (R. B.), Hooton (D. R.), & Clark (F. E.). **Soil bacteriological studies on the control of the Phymatotrichum root rot of Cotton.**—*J. agric. Res.*, lxiii, 9, pp. 535–547, 2 figs., 1941.

In experiments on the control of cotton root rot (*Phymatotrichum omnivorum*) [see preceding abstract] the fungus was observed to develop quickly and show little subsequent disintegration during 16 days when inoculated into quart jars half-filled with Hunt clay to which no organic material was added or only superphosphate, whereas in the presence of 3 per cent. farmyard manure or 3 per cent. chopped sorghum fodder in the soil, it either failed to grow or showed initial growth followed by disintegration. In similar experiments cotton seed meal and hulls and chopped cotton roots were likewise found to inhibit the growth of the fungus. In the field, cotton roots injured by clipping or girdling in late summer or early spring showed pronounced increases in micro-populations. Mycelium of *P. omnivorum* developed freely in Erlenmeyer flasks containing cotton roots in all stages of decomposition, sterilized to remove all competitive microbial activity and then inoculated with *P. omnivorum* alone, while it failed to grow in the unsterilized flasks, indicating that the survival of the fungus is limited by microbial interrelationships rather than by food exhaustion. In laboratory experiments only 19·6 per cent. of the sclerotia of *P. omnivorum* failed to survive when buried in soil receiving no organic residue, 14·4 per cent. in soil amended with superphosphate, while in soils amended with farmyard manure or chopped sorghum fodder, 64·9 and 69·7 per cent., respectively, were eliminated. Major reductions in sclerotial numbers were secured only during the periods of intensive microbial activity. Sclerotia surviving the period of increased microbial activity occasioned by fertilization persisted with little further reduction in numbers for several months. In Cholodny slide studies, it was observed in the early stages of incubation that viable young sclerotia disappeared from amended soils more rapidly than sclerotia killed by heat; the latter disappeared from amended soils in greater numbers than from unamended

ones. The application of either farmyard manure or sorghum fodder in the field by incorporating them into the upper 8 to 10 in. of soil by rotary ploughing in October, resulted in increased microbial activity, reduced incidence of dead cotton in the succeeding crop, and greater difficulty in the recovery of sclerotia from the amended levels in field soil.

Gottlieb (M.) & Brown (J. G.). **Sclerotium rolfsii on Cotton in Arizona.**—*Phytopathology*, xxxi, 10, pp. 944–946, 1 fig., 1941.

In addition to the recognized symptoms, the Arizona strain of *Sclerotium rolfsii*, which has caused such heavy damage to the cotton crop in the Salt River Valley and elsewhere during the past few years [*R.A.M.*, xx, p. 393], was found to be responsible for a swelling of the main stems near the soil-line, apparently a sequel to seedling infection. The fungus was most prevalent in nematode-infested soils, but was also present in fields free from the agent of root knot; it spread in a somewhat sporadic fashion following irrigations and summer rains throughout the growing season. About 16th December, a month after a killing frost, *S. rolfsii* showed much activity in these infested fields. Of great significance in relation to the perpetuation of infection is the detection of an abundance of inoculum on the decaying, ploughed-under stalks of the preceding cotton crop in fields showing no dying plants. The pathogen was first observed in Arizona in 1936 on larkspurs [*Delphinium*: ibid., xvii, p. 504] and subsequently appeared on sugar beets [loc. cit.] about 150 miles distant from the site of the first outbreak; it was next observed on the latter crop some 15 miles east of the affected cotton fields, to which, however, the manner of transmission remains for the present obscure. Mature cotton plants sustained exceptionally heavy damage from southern sclerotial rot in the epidemics under investigation, whereas Ezekiel and Taubenhaus [ibid., xi, p. 298] found only one dying from the effects of the disease, while their inoculation experiments of mature plants failed.

Alderson (V. G.) & Mason (Lucile R.). **Powdery mildews as allergens.** —*Calif. West. Med.*, lv, 5, pp. 241–243, 6 figs., 1941.

At the Oakland Clinics, California, in the spring of 1939, 65 out of 100 pollen-sensitive patients reacted positively to tests with spore extracts in Coca's solution of *Microsphaera alni* from valley oak (*Quercus lobata*) leaves on the Mills College campus. It is thought highly probable that the powdery mildews, which number at least 2,000 hosts, are the agents of many perplexing cases of allergy.

Ludlam (G. B.) & Henderson (J. L.). **Neonatal thrush in a maternity hospital.**—*Lancet*, cclxii (i), 6177, pp. 64–70, 4 figs., 2 graphs, 1942.

This is a very comprehensive study on the incidence of thrush (*Monilia* [*Candida*] *albicans*) in an Edinburgh maternity hospital, accompanied by considerations on the sources of infection, the factors affecting the disease, and its prophylaxis. The fungus, which was present, at a conservative estimate, in 6·4 per cent. of a special series of infants [*R.A.M.*, vi, p. 33 *et passim*] observed between the second and tenth days of life in 1940, was identified by means of its morphological and cultural characters on Sabouraud's agar, its sugar reactions, and

agglutination tests with a specific serum. In connexion with the last-named criterion it is mentioned that a considerable amount of cross-agglutination with allied species took place, *M. candida* [*C. vulgaris*], for instance, agglutinating to the same end point as *C. albicans*, though not quite so strongly. In addition to the 163 cases comprising the special series, the mouths of 11 out of 60 unselected infants yielded *C. albicans*, which was further isolated from the throat swabs of 20 out of 60 nurses, and from the fingers of 3 out of 42.

Polayes (S. H.) & Emmons (C. W.). **Final report of the identification of the organism of the previously reported case of subacute endocarditis and systemic mycosis (Monilia).**—*J. Amer. med. Ass.*, cxvii, 18, pp. 1533–1534, 1 fig., 1941.

The fungus isolated from the first case of subacute endocarditis and systemic mycosis to have been clinically diagnosed and published [*R.A.M.*, xx, p. 164] formed on Sabouraud's agar budding ovoid bodies, 4 μ in diameter, with very sparse hyphae, and on maize meal agar similar budding elements, 3 to 4 μ in diameter, with delicate, short, freely branching but scantily budding submerged hyphae. On acid dextrose agar after ten days at 30° C. the colonies were ivory to yellow, glistening, with smooth or slightly scalloped margins, while those of the same age on blood agar at 37·5° were grey, smooth, glistening, non-haemolytic, low dome-shaped, with even edges 2 to 3 mm. in diameter. Acid and gas were produced in dextrose and levulose broths. The organism was identified as *Candida parakrusei*.

Lubchenko (A. E.). **Mycotic infection in northeastern Colorado. Epidermophyton of animal origin.**—*Rocky Mtn med. J.*, xxxviii, 11, pp. 862–867, 14 figs., 1941.

Epidermophytosis of animal origin, in contradistinction to trichophytosis from the same source [*R.A.M.*, xx, p. 17], is stated to be very rare in north-eastern Colorado, hence the interest of a case of the former in a 45-year-old man, who developed a large, suppurative, inflammatory lesion over the dorsal part of the hand, presumably from the skinning and handling of large numbers of rabbits. The *Epidermophyton* concerned was characterized by round or oval, intercalary and terminal chlamydospores, 5 to 6 μ in diameter, occurring singly or in chains, in contrast to the isolated arthrospores of *Trichophyton*, and by round spores, 3 to 4 μ in diameter, deposited in groups. The mycelia, which were observed in the stratum lucidum and stratum granulosum, were of two types, (1) interlacing, wavy, 2 to 3 μ in diameter, branching, sometimes furnished with terminal clubs; and (2) straight or curved, septate, with elements of variable length and shape, with or without processes. The fungus is considered to fall into McCarthy's multiform group, represented by *E.* [*T.*] *gypseum*.

Campi (Maria D.). **'Botrytis tulipae', parásito del Tulipán en la República Argentina.** [*Botrytis tulipae*, a parasite of the Tulip in the Argentine Republic.]—*Rev. argent. Agron.*, viii, 1, pp. 16–18, 2 pl., 1941.

Botrytis tulipae (identified by H. H. Whetzel) was isolated from straw-yellow, oval, sunken lesions, with water-soaked edges, on tulip flowers

from a Buenos Aires florist's in November, 1939, and again in June, 1941, from garden plants at San Miguel showing on the foliage elongated, depressed, pale olive-buff spots, with translucent margins; on the shoots similar, but somewhat darker spots becoming striate as growth advanced; and on the bulbs extensive, cinnamon-brown areas bearing the black, globose sclerotia of the fungus. The macroconidia, measuring 12 to 18 by 8 to 13 (mean 15·6 by 9·8) μ, were found exclusively on the host, in contrast to the hyaline, globose microconidia, 3 μ in diameter, developing in culture on hyaline, penicillate conidiophores. All the 20 tulip plants inoculated with the pathogen under humid conditions contracted infection of the leaves, shoots, and bulbs, from which re-isolation was effected.

Metcalfe (C. R.). **Damage to greenhouse plants caused by town fogs with special reference to sulphur dioxide and light.**—*Ann. appl. Biol.*, xxviii, 4, pp. 301–315, 1 pl., 2 figs., 2 diags., 1941.

In experiments started in 1935 in Kew Gardens, but brought to a standstill by the war, disease symptoms, which were observed to occur in greenhouse plants during or after fog (namely, shedding of flowers, buds, and leaves of begonias and other plants and the premature death of buds and flowers of orchids), were induced artificially by treating the plants with low concentrations of sulphur dioxide [*R.A.M.*, xix, p. 34]. These concentrations were found to be more toxic when the temperature and humidity were relatively high. By comparing the concentration of sulphur dioxide in the atmosphere on different days or at different times during a single day it was found that damage caused to plants was roughly proportional to the concentration of atmospheric sulphur dioxide. It was experimentally shown that disease symptoms were caused by toxic substances in the atmosphere rather than by poor illumination in foggy weather. Exposure of Gloire de Lorraine begonias for 12 hours per day to artificial light of moderate intensity from neon tubes alone or from neon tubes plus mercury vapour lamps resulted in earlier and more prolonged flowering and an increase in vigour as well as in the size of the flowers. Earlier flowering was also induced in *Euphorbia fulgens*, cineraria, and hyacinth by the same treatment and increased vigour in the first-named. By filtering the atmosphere through sphagnum soaked in 20 per cent. sodium carbonate solution sulphur dioxide was effectively removed from the atmosphere in laboratory experiments, but further trials are required before it can be generally recommended.

For the prevention of the damage the author suggests (1) making the greenhouses as air-tight as possible; (2) placing boiler-house chimneys so that the prevailing wind blows the flue gases away from the houses; (3) making the chimneys as high as possible; (4) using a fuel that emits little sulphur dioxide (e.g., oil fuel); (5) protecting valuable plants with paper coverings; (6) maintaining the plants at a temperature and humidity as low as possible; and (7) using fans to introduce filtered air from outside.

Moore (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 206–210, 1 pl., 1941.

Continuing his observations on uncommon plant diseases in England

[*R.A.M.*, xx, p. 193], the author states that in May, 1941, *Cypripedium callosum* plants in a nursery in Hertfordshire showed rounded or elongated, watery, uniformly deep brown blotches on the leaves, up to 1½ in. across, and often with a pale brown margin ⅛ in. wide, surrounded by a water-soaked halo also about ⅛ in. broad. Smaller, irregular, brown spots without the halo were also present. From infected tissues a species of *Penicillium* was isolated which was proved by inoculation experiments to cause the disease, the fungus being re-isolated. It was identified as a strain of *P. thomii* [ibid., xviii, p. 457]. Infection occurs only through wounds, and young leaves are less susceptible than older ones.

In May, 1936, the author observed *Cercosporella primulae* on leaves of a *Primula juliae* hybrid near Southampton showing the yellow-brown or brown spots generally attributed to *Ramularia primulae* [ibid., xvii, p. 113]. Some of the seedlings of this hybrid were also attacked by *Peronospora oerteliana*; the grower discarded the plants with pale or spotted foliage, and divided and replanted the remainder. Late in July, the leaves showed spots indistinguishable macroscopically from those observed earlier, but *R. primulae* alone was found on them. The two fungi are probably related genetically [cf. ibid., xviii, p. 598].

In July, 1941, two clumps of *Helenium* 'Moerheim Beauty' in the author's garden just coming into flower bud developed leaf spot. The spots measured ½ to 2 cm. in diameter, and were scattered or spread away from the leaf edges; sometimes they coalesced. They were greenish-brown, tan, or chocolate-brown, paler later, rounded, sharply defined, often with a more deeply coloured margin about ½ mm. broad, and developed chiefly on the lower leaves, occasional spots occurring on the stem leaves a foot or more above soil-level. The spots bore the pycnidia of *Septoria helenii*; they were individually pale brown with a thin parenchymatous wall, somewhat thickened and darker round an ill-defined ostiole and 66 to 112 μ in diameter. The straight or curved, hyaline, 0- to 4-septate spores were slightly pointed at the ends and measured 22 to 39 by 2 to 3 μ.

Singh (B.). **Bulb rot of Scilla nutans caused by Penicillium cyclopium Westling.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 194–199, 1941.

During the summer of 1938, a consignment of Dutch-grown bluebells (*Scilla nutans*) was found to show rotting of the bulb scales due to *Penicillium cyclopium* [*R.A.M.*, xix, p. 221]. Bulbs obtained from English woods were similarly infected, as were imported bulbs of *S. campanulata*. Inoculation tests demonstrated that the fungus was able to penetrate wounded bulbs of *S. nutans*, *S. campanulata*, *Iris*, and *Lilium regale*, but was unable to infect unwounded *S. nutans* bulbs. Strains from *L. regale* and *Iris* were able to infect wounded *S. nutans* bulbs.

In field and greenhouse tests more disease developed in wet than in well-drained soil. Small-scale experiments indicate that infection was greatly increased when bulbs were stored under conditions of high temperature and humidity.

Snyder (W. C.). **A Fusarium wilt of Sweet William (Dianthus barbatus).**—*Phytopathology*, xxxi, 11, pp. 1054–1056. 1 fig., 1941.

The pathogen responsible for a typical wilt disease of sweet william

(*Dianthus barbatus*), first observed by C. M. Tompkins in two localities of California in 1939, presented in pure culture on potato dextrose agar the characteristic features of *Fusarium oxysporum* and gave positive results in an extensive series of soil inoculation experiments on a white-flowered variety of its own host, but not on carnations. This being the case, and in view of the fact that sweet william has not hitherto been recorded as a host of *F. oxysporum*, the fungus under observation is designated, in comformity with Snyder and Hansen's species concept in the genus [*R.A.M.*, xix, p. 495], as *F. oxysporum* f. *barbati* n.f.

Van Der Merwe (C. P.). **Plant protection.**—*Fmg S. Afr.*, xvi, 188, pp. 371–372, 1941.

In discussing protection against the introduction of plant pests and diseases from one country into another the author states that a few years ago *Antirrhinum* [*majus*] plants imported from England were observed by a gardener to be affected by a rust [*Puccinia antirrhini*: *R.A.M.*, xx, pp. 150, 448] not previously known in South Africa. The occurrence was not reported. Eventually, the plants were destroyed, but by that time infection had become established, and since then the disease has spread all over the Union and into Rhodesia.

Ruehle (G. D.). **Poinsettia scab caused by Sphaceloma.**—*Phytopathology*, xxxi, 10, pp. 947–948, 1 fig., 1941.

Poinsettia (*Euphorbia pulcherrima*) near Goulds, Florida, was observed in July, 1940, to be suffering from an unusual disease characterized by the development on the canes of raised, circular to elongated, often confluent cankers, 1 mm. to 1 cm. or more in length, the centres of which gradually sink and become covered with a greyish to greyish-brown, velvety layer of conidiophores and conidia of the *Sphaceloma* type. The foliar lesions are smaller than those on the canes and are mostly restricted to the petioles, midrib, and veins: except for their usually paler colour, they closely resemble the scab spots on citrus leaves due to *S.* [*Elsinoe*] *fawcetti*, and pure cultures of the fungus on potato dextrose agar also gave rise to colonies of the same type as those of the citrus pathogen. Positive results were obtained in inoculation experiments with the poinsettia organism on its own host, but not on rough lemon seedlings. Anna E. Jenkins states *in litt.* that no *Sphaceloma* disease of poinsettia is known, and further researches on the infected material are in progress.

Wernham (C. C.). **New facts about eastern snowmold.**—*Phytopathology*, xxxi, 10, pp. 940–943, 1 fig., 1941.

In 1939, isolations from specimens of snow mould on Colonial bent (*Agrostis tenuis*) [*A. vulgaris*] at the State College and elsewhere in Pennsylvania, yielded only a fungus identified by Ruth Remsberg as *Typhula itoana* [*R.A.M.*, xix, pp. 200, 434], while parallel isolations from similarly affected turf from Minnesota yielded a *Fusarium* and a sclerotial Basidiomycete believed to be an undescribed species of *Typhula*. In inoculation experiments with *T. itoana* the variety Astoria, a Colonial type of *A. vulgaris*, listed by Dahl and others as resistant to *F. nivale* [*Calonectria graminicola*: ibid., xiii, p. 521], proved

susceptible, the same being true in an even higher degree of the likewise reputedly resistant Metropolitan strain of *A. palustris*. Among other strains of *A. palustris* tested for their reaction to *T. itoana*, one from 'South' was resistant, one from a mixed strain susceptible, one from 'bent' very susceptible, two out of five Washingtons resistant, two moderately susceptible, and one susceptible, and Monteith's strain C[1], reported to be resistant to large brown patch [*Rhizoctonia* sp.: ibid., v, p. 742], very susceptible. In view of these conflicting observations, a re-classification of turf grasses in relation to their reactions to *T. itoana* would seem to be imperative.

Broadfoot (W. C.) & Cormack (M. W.). **A low-temperature Basidiomycete causing early spring killing of grasses and legumes in Alberta.**—*Phytopathology*, xxxi, 11, pp. 1058–1059, 1 fig., 1941.

Lucerne and various grasses are extensively killed off in the early spring in Alberta by an unidentified Basidiomycete, possibly allied to *Typhula* but excluded from the species studied by Ruth Remsberg [see preceding abstract] by the complete absence of sclerotia either in nature or in culture. The fungus, which was first isolated in 1931 from grasses severely damaged by snow mould [*R.A.M.*, xv, p. 811] and later from a destructive crown rot of lucerne, was pathogenic to Kharkov wheat seedlings and 22 species of grasses in inoculation experiments in 1940–1, *Bromus inermis* being the only one to give any indication of resistance. In the central and northern parts of the State the dark brown crown rot of lucerne may be responsible for the loss of up to 50 per cent. of the crop, and similar heavy damage is likewise sustained by all the clover [*Trifolium* spp.] and sweet clover [*Melilotus*] varieties so far tested. In fact, the pathogen, which develops most profusely at temperatures round about 15° C., with a minimum and maximum at —4° and 26°, respectively, is the most virulent of all those hitherto isolated from lucerne crowns and roots in Alberta.

Baur (K.), Huber (G. A.), & Wheeting (L. C.). **Boron deficiency of Alfalfa in Western Washington.**—*Bull. Wash. St. agric. Exp. Sta.* 396, 16 pp., 5 figs. (2 col.), 1941.

Surveys from 1937 to 1940 showed that boron deficiency in lucerne, commonly referred to as 'yellows' [*R.A.M.*, xxi, p. 22], is widespread in Western Washington, particularly in plantings on upland soils. The affected plants are characterized by a yellowing and reddening of the leaves, are severely dwarfed, and rarely form flowers. In pot culture studies and field trials the deficiency was satisfactorily controlled by applications of 50 to 60 lb. borax (sodium borate) per acre to silt and clay loam soils, and by 30 to 40 lb. on the lighter soils such as loams, sandy loams, and sands. Both spring and autumn applications proved to be efficient, provided the material becomes dissolved and well incorporated into the soil. Applications of farmyard manure increased the lucerne yields in all cases, but failed to eliminate the deficiency symptoms completely, while poultry manure even tended to accentuate them. The borax may be applied after mixing with commercial fertilizer or inert materials, such as sand or soil, to increase the volume before application, or directly without mixing by using equipment such as the cyclone or the wheelbarrow grass-seeder.

Darley (E. F.). **Spore germination of Selenophoma bromigena.**—*Phytopathology*, xxxi, 10, pp. 953–954, 1 fig., 1941.

In the course of a study at University Farm, St. Paul, Minnesota, on collections from Canada, North and South Dakota, and Minnesota of *Selenophoma bromigena* Sprague & Johnson, the agent of a leaf spot of *Bromus inermis* [in Oregon] (*Mycologia*, xxxii, p. 415, 1940), the type of spore germination in distilled water was observed to differ from that on nutrient media. In sterile distilled water the spore develops a germ-tube from one end, occasionally from both ends, and is recognizable for some time, whilst on potato-dextrose agar the spore swells, becomes septate, and gives off germ-tubes from both ends and from newly formed cells, as many as three hyphae arising from one cell.

Taylor (G. G.) & Atkinson (J. D.). **Experimental orchard at Huapai, Auckland.** *N.Z. J. Sci. Tech.*, A, xxii, 6, pp. 338–347, 2 figs., 1941.

A neglected four-acre apple orchard on gum-land clay soil at Huapai, North Auckland, leased in 1937 for a three-year period by the Plant Diseases Division for experimental purposes, harboured the following fungi: powdery mildew (*Podosphaera leucotricha*), affecting particularly the Jonathan, Willie Sharp, and Gravenstein varieties; black spot [scab] (*Venturia inaequalis*) on some 50 per cent. of Willie Sharp fruit and 5 to 30 per cent. on other varieties; silver leaf (*Stereum purpureum*); and *Schizophyllum commune*, invariably associated with an unthrifty condition of the trees, and more especially with a tendency to sour sap. Following the institution of a general spray programme, full details of which are given, scab was rapidly controlled, the incidence of infection falling from 60 per cent. in 1935 to 0 to 5 per cent. after one season of spraying, and to an average of 0·1 per cent. after three years. The comparative ease with which *V. inaequalis* may be eliminated is attributed to the fact that the chief source of spring infection is the inoculum (mycelium or spores) overwintering on the tree itself.

Atkinson (J. D.) & Taylor (G. G.). **Renovation of a neglected orchard.**—*N.Z. J. Sci. Tech.*, A, xxii, 6, pp. 347–358, 6 figs., 1941.

The rehabilitation of a neglected four-acre apple and pear orchard on alluvial silt loam soil at Havelock North, which was leased by the Hawke's Bay Fruitgrowers' Association in 1935, necessitated, in addition to thorough pruning and cultivation, a full programme of disease control [see preceding abstract], chiefly directed against black spot [scab (*Venturia inaequalis* and *V. pirina*)], details of which are given. Two spray schedules are specified for the guidance of Auckland growers, the first, agreeing with the present recommendations of the Department of Agriculture, being generally applicable, and the second adapted for use in orchards where efficient disease control has already been practised, and where the methods of disinfection are of a high standard.

Britton (J. E.), Fisher (D. V.), & Palmer (R. C.). **Apple harvesting and storage in British Columbia.**—*Fmrs' Bull. Canad. Dep. Agric.* 105, 39 pp., 18 figs., 1941.

Included in this bulletin, in which 'an attempt has been made to present the problem of apple storage, not as a procedure set apart from

the rest of fruit growing practice, but as an integral part of it', are notes on some well-known storage disorders and their control.

Singh (U. B.). **Sooty-blotch and fly-speck of Apple fruit in Kumaun.**—*Indian J. agric. Sci.*, xi, 4, pp. 597–602, 1941.

Following a brief description of the superficial blemishes of apple fruits known as sooty blotch and fly speck, the former consisting of the dark brown, interwoven hyphae and the latter of the sclerotia of *Leptothyrium pomi*, the writer gives directions for the control of the disease in the United Provinces, India [*R.A.M.*, xx, p. 477]. Spraying with lime-sulphur or Avon's colloidal sulphur is effective, but tedious and unduly expensive. Thinning the fruits so as to leave 1½ per cu. ft. of the volume of the tree appreciably decreases the incidence of infection, besides increasing the size and improving the colour of the apples. Infection during a storage period of over six months was satisfactorily held in check by washing the fruits either in 5 per cent. bleaching powder or 3 per cent. sodium chlorate.

Andes (J. O.). **Experiments on the inheritance of the 'plus' and 'minus' characters in Glomerella cingulata.**—*Bull. Torrey bot. Cl.*, lxviii, 9, pp. 609–614, 1 diag., 1941.

A study of the inheritance of light and dark strain characters (Edgerton's 'plus' and 'minus', respectively: *Amer. J. Bot.*, i, pp. 244–254, 1914) in a race of *Glomerella cingulata* from a rotted apple from Tennessee showed that monoascosporic colonies were always light or dark. The light type is characterized by abundant light-coloured aerial mycelium, with sparse conidial development, and normal perithecia in groups, while the dark type produces very little aerial mycelium and becomes carbonaceous in a few days, forms abundant conidia and perithecia, but asci only rarely and then they are usually abnormal. When the two types are grown together a distinct line of perithecia with normal asci develops at the junction of the colonies. Asci from monoascosporic light clones yielded eight dark clones, or four dark and four light, except one perithecium which yielded five all dark and three all light clones. Monoascosporic dark clones gave asci that yielded only dark clones. Asci from perithecia that formed where the light and dark types met generally yielded eight dark clones or four dark clones and four light, though several such asci gave six dark and two light clones or two dark and six light clones. The explanation of the remarkable production of all dark clones or half dark and half light clones from asci originating from monoascosporic light lines awaits the results of further work.

Limited experiments with a northern race of the same fungus gave somewhat different results.

Baur (K.) & Huber (G. A.). **Effect of fertilizer materials and soil amendments on development of apothecia of Sclerotinia fructicola.**—*Phytopathology*, xxxi, 11, pp. 1023–1030, 2 figs., 1 graph, 1941.

This is an expanded account of the writers' tests at the Western Washington Experiment Station on the utility of various fertilizers and soil amendments in the suppression of the apothecia of *Sclerotinia*

fructicola, the agent of prune brown rot [*R.A.M.*, xxi, p. 27], a note on which has already appeared [ibid., xx, p. 24]. Calcium cyanamide, pulverized and oiled (5 per cent.), was the only one of the materials to give satisfactory results. Its toxicity is apt to be impaired by prolonged contact with wet soil, but under relatively dry conditions its fungicidal action persists over the period of two to three weeks required for the emergence of all the apothecia under local conditions. Hence it is advisable to delay the application of the compound until just before the discharge of the fruit bodies is expected. After testing several commercial machines, a home-made duster, with a capacity of 3 acres per hour, was eventually adopted, consisting of a narrowed-down motor, the hopper holding 300 lb. calcium cyanamide, which dropped directly into a 16 in. fan with 4 in. blades revolving horizontally and was blown into a 12 ft. tapered boom with $\frac{3}{8}$ in. holes at 1·5 in. intervals along its lower side, the outer 18 in. section being elevated at an angle of 45° to permit of dusting the entire soil surface without cross treatment. The boom was fitted with a burlap hood, 3 ft. wide, over a framework of iron pipe and bamboo rods to prevent the dust from blowing into the trees [cf. ibid., xx, p. 336].

Cation (D.). **The line pattern virosis of the genus Prunus.**—*Phytopathology*, xxxi, 11, pp. 1004–1010, 4 figs., 1941.

Abundance and Red June plum trees with apparently normal foliage may transmit to Elberta, Hale, and Carmen peaches, Mahaleb cherries, and almonds by grafting a disease manifested by a faint mottling of either a line-pattern or diffused type; *Prunus salicina* is also susceptible, but frequently shows no external symptoms of infection. The virus responsible for the trouble, which is apparently similar to, or identical with, that described by Valleau [*R.A.M.*, xii, p. 454] and Thomas and Rawlins (as 'Vacaville plum mosaic') [ibid., xix, p. 417], is herein designated peach line-pattern virosis (*Marmor lineopictum*). It is probably general throughout the United States, and is actually known to occur in Kentucky, Michigan, California, and Ohio. Another disorder of Abundance plums resembling in some respects that caused by Valleau's unnamed virus and perhaps related to Thomas and Hildebrand's prune virus [ibid., xvi, p. 330], designated Prunus virus 6 by K. M. Smith [ibid., xvii, p. 52], failed to transmit perceptible symptoms to peach in three inoculations.

Berkeley (G. H.). **Prune dwarf and Shiro line-pattern mosaic.**—*Publ. Div. Bot. Pl. Path., Ottawa*, 679, 2 pp., 2 figs., [1941].

Two Shiro plum and three prune orchards in Ontario have been found to be affected with virus diseases new to the Province, the former with 'line-pattern mosaic' [see preceding abstract], the latter with 'dwarf' [*R.A.M.*, xvi, p. 330]. In prune dwarf the leaves on infected branches become reduced in size, narrow, rugose, distorted, and somewhat glazed, so that they rather resemble willow leaves; the disease is, in consequence, sometimes referred to as prune 'willow leaf'. Affected shoots often occur on an otherwise apparently healthy branch, diseased shoots being interspersed with apparently healthy ones. Fruit from affected branches appears normal, but yield is greatly reduced. The disease has

also been reported from New York State and British Columbia. In two of three orchards affected in Ontario the condition appeared after damsons had been top-worked with Italian prune.

In the two Shiro plum orchards the affected trees in early summer showed yellowing of the veins of the leaves, with pronounced yellowish patterns. Subsequently, the yellow areas turned almost white. Foliage emerging in hot weather did not always show any symptoms, which were, however, conspicuous on leaves unfolding earlier and on those formed in cooler weather. In one of the orchards some plums of the 'First' variety were slightly affected. Twenty-five Shiro trees were top-worked with First, and next season became affected. In two years, the condition was present on a further 34 trees. Examination of the First trees from which the scions were taken showed the presence of the disease, and the available evidence indicated that these First trees were responsible for the initial infection in both Shiro orchards.

As both diseases have been discovered in top-worked orchards, growers are advised to take special care to see that trees to be top-worked are healthy. No bud sticks or scions should be taken from any but healthy trees. Prune trees affected with dwarf should be destroyed.

BERKELEY (G. H.). **The 'X' disease on Peach and Chokecherry.**—*Publ. Div. Bot. Pl. Path., Ottawa*, 678, 2 pp., [1941].

The first records of 'X' disease of peaches [*R.A.M.*, xx, p. 540] in the Niagara Peninsula, Ontario, were made on 25th July, 1941, but much of the evidence indicates that the disease has been present in some orchards for four years. A limited survey showed that though the western section of the peninsula (Bartonville district) is chiefly affected, some 70 diseased trees were found in the vicinity of Niagara town, and one near Beamsville. Spread takes place only from chokecherry (*Prunus virginiana*) to peach and not from peach to peach. In Connecticut and New York States, the disease has spread so rapidly in some localities that some orchards have become useless from a productive standpoint in only two years. In Ontario, spread has been less rapid, e.g., in two orchards where it is considered that the condition has been present for four years only 7 and 15 per cent., respectively, of the trees are affected. Every step must, however, be taken to check spread. Control consists in destroying all chokecherries within 500 ft. of any peach orchard by spraying them while in full leaf with a proprietary weed killer which has a sodium chlorate base, or with sodium chlorate alone used at the rate of 1 lb. per gal. water. It may be necessary to repeat the application a year later. The spray should be used at the rate of 1 or 2 gals. per 100 sq. ft. of area.

NATTRASS (R. M.). **Notes on plant diseases.**—*E. Afr. agric. J.*, vii, 2, p. 68, 1 fig., 1941.

Peaches, almonds, and nectarines are attacked by *Taphrina deformans* [*R.A.M.*, xx, p. 558] in Kenya, particularly at the higher altitudes, where the low temperatures and high humidity prevailing during part of the year favour infection. Brief directions for control are given.

Thurston (H. W.), Taylor (C. F.), Groves (A. B.), & Miller (H. J.). **Interstate cooperative experiments on field spraying of sour Cherries.** —*Phytopathology*, xxxi, 11, pp. 1047–1050, 1941.

A fully tabulated account is given of co-operative experiments conducted in 1940 in Virginia, West Virginia, and Pennsylvania to determine the most effective preparations for the control of cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xx, p. 481], on the Montmorency variety in 13 single-tree plots and a check, randomized and replicated sixfold within each State, four applications being made at (1) petal-fall, (2) shuck-fall, (3) three-week cover, and (4) post-harvest. After eliminating Bordeaux mixture and tank-mix copper phosphate because of their detrimental effect on the size of the fruit, and lime-sulphur and phenothiazine on account of their consistent failure to combat the pathogen, there remained for further consideration nine materials, of which basicop and ZO were rejected for the inconsistency of their performance, their efficacy in the late outbreak of the disease in West Virginia not being maintained under the more exacting conditions prevailing in the other two States. Compound A ensured the best average leaf retention for the three States, with 76·18 per cent. still on the trees in the first week of October, followed by Tennessee '26' and Nu-film, Tennessee '26' alone, copper hydro '40', and cupro K, with 74·73, 72·47, 72·00, and 71·77 per cent., respectively, the control figure being 4·67 per cent. The numbers of cherries per pound sample treated by these five preparations were 119·4, 113·3, 117·8, 112·2, and 113, respectively, compared with 107·6 for the control.

Dodge (B. O.) & Wilcox (R. B.). **Diseases of Raspberries and Blackberries.**—*Fmrs' Bull. U.S. Dep. Agric.* 1488, 33 pp., 20 figs., 1941.

In this revised edition (by J. B. Demaree) of the earlier bulletin by Dodge and Wilcox on the same subject [*R.A.M.*, vi, p. 40], the more important fungal and virus diseases of raspberries, blackberries, and dewberries [*Rubus* spp.] found in the United States are described and illustrated, and practical recommendations are given for their control.

Croucher (H. H.). **Efficient spraying to control leaf spot.**—*J. Jamaica agric. Soc.*, xlv, 8, pp. 284–287, 1941.

After pointing out that there is considerable evidence of inefficient spraying by banana-growers against leaf spot due to *Cercospora* [*musae*: *R.A.M.*, xx, p. 265] in Jamaica, the author gives a scale by which the intensity of infection on sprayed and unsprayed banana plants may be estimated (ranging from stage 1, unaffected, to stage 6, very heavy infection, i.e., very severe spotting, plantations of a prevailing brown or scorched appearance, with premature ripening of the bunches on the plants). He states that it is not as yet possible to tell at what precise stage of infection a tree will just fail to produce marketable fruit, especially as this may vary with different localities and seasons. Efficient spraying should, however, reduce infection at least to stage 2 (very slight infection, only occasional, isolated leaf spots present), and this should be every grower's aim. If bananas sprayed regularly for three to four months have more spots than are present in stage 3 (slight infection, general light spotting of the leaves, or light spotting in

certain areas of the field), then the spraying is probably inefficient. If the trees are in stage 4 (moderate infection, general light spotting with localized patches in which many leaves per plant are severely affected or 'badly burned'), either the spraying methods are radically wrong, or infection was too heavy to begin with.

The main causes of inadequate control by spraying are (1) not cutting back heavily infected trees before beginning to spray, (2) irregular spraying cycles, and (3) poor coverage by the spraying mixture. The minimum cycle advised for all areas is three to four weeks. In some places, especially where an infected area is being brought under control, the applications should be made even more frequently. If the number of new leaves showing no sign of spray mixture is multiplied by 10, the result gives the minimum number of days elapsing since the last spraying. Poor coverage may be due to careless application, allowing the pump or jet to get out of order, using too little spray (minimum, $\frac{1}{3}$ gal. per tree with power equipment, $\frac{1}{4}$ to $\frac{1}{5}$ gal. with hand sprayer), or spraying with a mixture rendered unsatisfactory by inaccurate measurement of the materials or by a faulty method of preparation.

Bunchy top position at Yarrahappini.—*Banana Bull., Sydney*, i, 62, pp. 9, 16, 1941.

The position as regards bunchy top of bananas in the Yarrahappini area of New South Wales [*R.A.M.*, xix, p. 31; xx, p. 171] is not yet such as to admit of the lifting of the quarantine restrictions, but substantial progress has been made since the inception of the campaign against the disease four years ago, only four infected plants having been found during the present season as compared with 99 in the first.

Wager (V. A.). **The dying back of Avocado trees in southern California.**—*Yearb. Calif. Avocado Ass., 1940*, pp. 40-43, 1940. [Abs. in *Biol. Abstr.*, xv, 10, p. 2273, 1941.]

Debility, sparse foliation, and crop failure are among the symptoms of a die-back affecting some 500 acres of avocado plantings in southern California. The roots of diseased trees were discoloured and necrotic, the larger ones also bearing cankers and showing signs of decay, while the lesions on those of all sizes yielded *Phytophthora cinnamomi*, which readily infected plants submerged for only one day following inoculation, though in the absence of the pathogen the roots can withstand six to nine days' submersion without injury.

Parris (G. K.). **Diseases of Papaya in Hawaii and their control.** *Ex* **Papaya production in the Hawaiian Islands.**—*Bull. Hawaii agric. Exp. Sta.* 87, pp. 32–44, 7 figs., 1941.

The following diseases of papaw are described as occurring in Hawaii. Anthracnose (*Colletotrichum glocosporioides*) [*R.A.M.*, xxi, p. 88] is spread by wind, rain, insects, and probably man, while partly or completely rotted fruits on the refuse heap or over-ripe fruits on the tree constitute a serious source of infection. While the use of Bordeaux mixture is not advised owing to risk of russeting that is caused by it, it is reported that Kikuta (*Progr. Notes Hawaii agric. Exp. Sta.* 18,

5 pp., 1941) obtained 98 per cent. control of anthracnose without injury to the tree or fruit by spraying with cuprocide 54 and cuprocide 54 Y.

Fruit rot caused by *Alternaria* (? *citri*) is stated to be relatively unimportant in Hawaii and needs no special treatment, as it is controlled by the sprays applied against anthracnose.

Powdery mildew, caused by *Oidium caricae* [*R.A.M.*, xxi, p. 88], is satisfactorily controlled by spraying with copper or sulphur fungicides at monthly intervals, or more often if the disease recurs sooner.

Phytophthora parasitica [ibid., xx, p. 350], causing a hard rot of the stem, the fruits, and occasionally the collar and roots of the plant (leaves were seen attacked in the laboratory only), was observed at several localities on the island of Oahu and it is believed that it may become a serious menace. For the control of this disease Bordeaux mixture is not recommended on account of russeting, but spraying with a copper fungicide is stated to give satisfactory results. When the stem is decapitated below the diseased region, suckers develop and fruit formation is resumed earlier than when young trees are planted.

Root rot, due chiefly to *Pythium* spp. (one of which was identified by J. T. Middleton as *P. aphanidermatum* [ibid., xx, p. 480]) and to a lesser degree to *Fusarium* spp., causes a retardation in the growth of the plants, premature leaf fall, stunting of the apex, stem rot, and poor anchorage of the roots, which are discoloured and partly decayed. The fungi enter the roots through wounds or directly if they are unthrifty. Diseased plants should be uprooted and burnt, the holes left exposed to the sun or disinfected with a weak Bordeaux solution, and not replanted for some time. Root rot is particularly favoured by excessive moisture and flooding should, therefore, be avoided.

Species of *Pythium* and *Rhizoctonia* are held responsible for a post-emergence damping-off [cf. ibid., xx, p. 350] often causing severe losses of seedlings. The plants wilt rapidly showing a darkened, water-soaked spot on the stem near soil-level, turn brown, dry out, and die, sometimes becoming covered with a darkish or light grey mould. The disease can be controlled by soil sterilization with heat or formaldehyde at least 10 days or preferably a fortnight before planting, the best means, steam, being too expensive to administer.

It is confirmed that mosaic has been absent from the island of Oahu since 1939 [loc. cit.].

Parker Rhodes (A. F.). **Studies on the mechanism of fungicidal action I. Preliminary investigation of nickel, copper, zinc, silver and mercury.**—*Ann. appl. Biol.*, xxviii, 4, pp. 389–405, 1941.

In a study on the fungicidal action of metals, the effects of various compounds of nickel, copper, zinc, silver, and mercury were observed on *Macrosporium sarcinaeforme* [*Stemphylium sarciniforme*: *R.A.M.*, xix, p. 665] and *Botrytis allii*. The interpretation of the results obtained was based on two theorems: (1) if the tolerance (measured by the atomic concentration of metal just sufficient to prevent germination of the given spore) of spores towards a certain compound is normally distributed, the variability (defined as a statistic involving the second but no higher moment of the variate, which is the tolerance of spores to the action of metallic ions) can be measured by the relative variance, that

is, the ratio of the variance to the square of the mean; and (2) if the logarithm of the tolerance is normally distributed, the variability can be measured by the variance of the logarithm. The following conclusions, put forward only as the simplest explanation of the facts, were drawn from the results: copper is absorbed by the spores more readily in the form of the monohydrated dithioureocuprous ion, or a related compound, than as the simple cupric ion, certain cupric complex compounds apparently requiring decomposition before absorption; zinc is more readily absorbed as the dithioureozinc ion; silver in the form of the dithioureargentous ion requires decomposition (at least as was observed in one case) before absorption; mercury in the form of the tetrathioureomercuric ion requires decomposition before absorption. It appeared that the variability is less affected by temperature fluctuations than by some other statistics.

Petri (L.). **Einige Fragen der allgemeinen Pflanzenpathologie.** [Some problems of general phytopathology.]—*Ann. Fac. agr. Pisa*, N.S., iii, pp. 229–261, 1940. [Abs. in *Chem. Zbl.*, cxii (ii), 20, p. 2452, 1941.]

The writer's studies are concerned primarily with the immunity of plants from diseases and parasites or their resistance to these agents. On the grounds of practical experience he rejects the serological and internal-therapeutic methods of control, and envisages a successful outcome of the attempts in progress at the extension of resistance by the development of new strains with the required characters or the propagation of those already in existence.

Carter (W.). **Insects and the spread of plant diseases.**—*Rep. Smithson. Instn, 1939–40*, pp. 329–342, 6 pl., 1941.

The writer cites some important examples of the part played by insects in the transmission of plant diseases, and discusses the implications of this mode of dissemination in connexion with control problems and future developments in phytopathological knowledge.

Romell (L.-G.). **Localized injury to plant organs from hydrogen-fluoride and other acid gases.**—*Svensk bot. Tidskr.*, xxxv, 3, pp. 271–286, 1 fig., 1 graph, 1941.

Norway maples (*Acer platanoides*) and oaks in a park in Sweden some 400 m. distant from a factory emitting fluoric gases developed marginal leaf curl, accompanied in the case of the purple-leaved form of *A. platanoides* by a dulling of the normal colour of the edges only, the remainder of the leaf surface being unaffected. Ordinary Norway maples and oaks showed foliar blotches of a slightly paler than normal green, while the margins of apple leaves turned brown, and in some cases patches of discoloured tissue were also present on the surface. An analysis of the fluorine contents of (a) visibly damaged parts, (b) remaining portions of the same leaves, and (c) leaves with no apparent injury yielded the following data: ordinary Norway maple, 42, 0, and 0 parts per million dry weight, respectively, purple-leaved, 22, 16, and 6, respectively, and apple, 17, 0, and 0, respectively.

Discussing the etiology of localized lesions from acid gases in smoke

[*R.A.M.*, xvi, p. 701, and cf. above, p. 140] the writer refutes the idea that they are due to 'corrosion', i.e., the direct absorption of acid from a liquid through the cuticle independently of the stomata, and attributes the so-called 'border effect', typified by the injuries described above, to an uneven uptake of acid gas in a distorted diffusion field, along the protruding edges of which the critical threshold is first reached.

The use of indicator papers for the estimation of the atmospheric content of certain acid gases is suggested: an easily prepared aluminium-haematein lake paper (prepared by staining hardened filter paper overnight in Delafield's haematoxylin diluted 1 in 100 distilled water, washing in tap water, then in distilled water, and drying), for instance, was found to give a sensitive and specific border reaction to hydrogen fluoride. Tests with such papers showed that hydrogen chloride, hydrogen fluoride, and nitric acid are much more liable to induce the border effect than the considerably less soluble, and hence less readily absorbed sulphuric acid.

Furry (Margaret S.) & Robinson (Helen M.). **Effective mildew-resistant treatments for Cotton fabrics.**—*Amer. Dyest. Rep.*, xxx, 20, pp. 504, 520–523, 1941.

In continuation of previous studies initiated by the United States Bureau of Home Economics (*Industr. Engng. Chem.*, xxxiii, 4, pp. 538–545, 1941), the writers tested finishing treatments for the control of mildew (*Chaetomium globosum*) on an 8-oz., de-greased and de-sized, unbleached cotton duck fabric [*R.A.M.*, xxi, p. 89], strips of which were inoculated with the fungus and incubated for a fortnight.

Very satisfactory protection was afforded by the acetylation process, involving 20 hours' exposure to acetic anhydride, glacial acetic acid, and zinc chloride at 20° to 25° C.; 30 minutes in a 15 per cent. solution of chlorothymol (25° to 30°), refluxed for four hours with morpholine and sodium carbonate to form an oil yielding crystals which melt at 54°; cutch (100°, overnight), followed by 10 to 15 minutes in copper sulphate and ammonium hydroxide at 25° to 30°; 2-chloro-orthophenylphenol and pentachlorophenol (30 minutes), which may also be condensed with morpholine to eliminate the sharp, irritating odour of these products, while a two-bath treatment with (a) cadmium chloride and (b) sodium pentachlorophenolate (15 minutes each) also proved eminently satisfactory for the inhibition of the mould; salicylanilide (30 minutes at 25° to 30°) for non-steam-sterilized material, or in the form of an emulsion mixed with wax and aluminium acetate (3 minutes at 80° to 85°) for steamed fabrics; 30 minutes at 25° to 30° in alkyl dimethyl benzyl quaternary ammonium phosphate or chloride; copper propionylacetate, paratolyl mercury salicylate, and phenyl mercury oleate, all for 30 minutes at 20° to 25°, the first-named imparting a grey-green tint to the material; copper and zinc naphthenates, applied either in water or Stoddard solvent for 30 minutes at 25° to 30°, the former green, the latter colourless, both having a pungent, disagreeable odour and tending to stiffen the fabric; two-bath processes of sodium oleate soap with cadmium chloride or copper sulphate, 10 minutes in the soap and 30 in the chemicals, both at 100°; cadmium chloride or copper sulphate (15 minutes at 100°), followed by 15 minutes in morpho-

line at 25° to 30°; 30 minutes in either aluminium acetate or magnesium chloride at 100° and 15 in 8-hydroxy quinoline at 25° to 30° (bright and dull yellow, respectively); and 30 minutes in cadmium chloride at 25° to 30° followed by 10 in borax.

None of these treatments caused any appreciable loss in the strength of the fabric, and a few even seemed to increase it. In this connexion it is pointed out that a change in breaking strength due to mildew growth is of little or no importance even under the exacting conditions provided by laboratory experiments, while for many practical purposes treatments permitting 20 or 25 per cent. deterioration would be quite reliable.

Thompson (J. C.) & Sanford (W. E.). **Modern paints for mold control in the brewery.**—*Brew. Dig.*, xvi, 5, pp. 27–30, 4 figs., 1941.

The moulds most frequently encountered in American breweries [*R.A.M.*, xix, p. 718] are stated to be *Aspergillus glaucus*, *Penicillium glaucum* (in green malt), and *Botrytis cinerea* (on wort). Collectively these organisms are responsible for heavy losses every year, and many experiments have been undertaken with a view to their control. In this connexion it is necessary to run constant tests for the evaluation of the efficacy of various fungicides and paints, which may be carried out by means of a wooden box, 3 ft. in width, 8 ft. in length, and 3 ft. in depth, the bottom of which is filled to a depth of 6 or 8 in. with water heated by an electric immersion heater, while across the centre is a partition extending from the top down to just above the water-line. The panels painted with the test substances are hung on pegs round the sides, and the top is fitted with hinged covers, the temperature being maintained at 84° F., the optimum for the majority of moulds. The cabinet thus provides ideal conditions for fungal growth, viz., warmth, moisture, and darkness, the only missing element being food, which is supplied by the paints themselves. Hundreds of tests have been run in this cabinet and, in conjunction with practical experience, have contributed extensively towards the incorporation of fungicidal substances in the interior finishings of breweries and other food-manufacturing installations.

Among the requisites of a modern paint, besides resistance to moulds, are maximum resistance to discoloration in the presence of fumes, gases, heat, or protracted absence of daylight; suitability for application at low temperatures in excessively moist conditions; and freedom from toxicity to foodstuffs, beverages, and the like. Before applying new paint, the surfaces should be thoroughly cleansed with a solution of trisodium phosphate or sodium carbonate in hot water, and drying should be followed by sterilization with sodium hypochlorite in water, using either a calcimine brush or spray equipment. After further alternate drying and rinsing, the new paint is applied, the final coat, the 'fungicide clear coat', consisting of a thin, colourless, antiseptic film effectively retarding bacterial and fungal growth.

Jones (L. H.). **Coin mats for the microscopist.**—*Science*, N.S., xciv, 2445, p. 446, 1941.

The use of coin mats is recommended to facilitate the handling of cover glasses and slides.

Proceedings.—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 215–220, 1941.

Abstracts of the following papers read at meetings of the British Mycological Society in 1941 have not been noticed from other sources. Dillon Weston, discussing field observations on cereal diseases and their control, states that no marked difference was observed from year to year in the intensity of loose smut (*Ustilago tritici*) infection on well established English wheat varieties, but certain recently introduced varieties have been more seriously affected. In experimental work grain treated by the hot water method is dried over a wind channel, as the germinating capacity of stored moist grain is impaired. The farmer is usually advised to obtain seed from a healthy crop or to change to a resistant variety. Wheat varieties infected with *Tilletia caries* generally show increased susceptibility to *Puccinia glumarum*. Doubt is expressed whether barley leaf blotch (*Rhynchosporium secalis*) [*R.A.M.*, xix, p. 643] is as unimportant as it is sometimes considered to be. There is no experimental evidence that infection is seed-borne; the disease probably carries over from year to year on rogue barley and on grasses.

S. P. Wiltshire presented evidence of the continued spread of major crop diseases in spite of legislation, and cited instances where appropriate action might have prevented the introduction of disease had information been available. He suggested that better intelligence is required about the distribution of plant diseases, their methods of transmission, and trade channels.

F. C. Bawden reported that, many plant pathologists being dissatisfied with present methods of recording plant diseases in the field, a special meeting of the Plant Pathology Committee was held in February, 1941, and a model scheme drawn up for recording the incidence of six diseases.

Frampton (V. L.) & Longrée (Karla). **The vapor pressure gradient above a transpiring leaf.**—*Phytopathology*, xxxi, 11, pp. 1040–1042, 1 graph, 1941.

The microclimate adjacent to the leaf surface plays an important part in fungal development, and the authors have devised a method of determining the relative humidity at the surface of a leaf based on the equation: $\log(R-S)-\log M = -\frac{v}{D}x$, where R = relative humidity at a given distance from the surface, S = relative humidity at a long distance from the surface, D = diffusion constant, v is the normal component of velocity induced by an extraneous disturbance, e.g., streaming, convection currents, or gravitational force, and M assumes the dimensions of relative humidity. At the surface of the leaf R = M+S, and it is only necessary under suitable experimental conditions to measure S and R at two arbitrary points in order to determine the relative humidity at the leaf surface.

Lindegren (C. C.) & Lindegren (Gertrude). **X-ray and ultraviolet induced mutations in Neurospora. I. X-ray mutations.**—*J. Hered.*, xxxii, 11, pp. 404–412, 2 figs., 1941.

In the authors' experiments at the University of Southern California, Los Angeles, the exposure of uninucleate spores of *Neurospora crassa* to

X-rays (25 minutes at 13,750 or 40 at 22,000 r units) induced both gene mutations and chromosal aberration. Abortion of ascospores occurred in the progeny of about half the mutants, and one such case, which is fully analysed, was specifically identified as an inversion. Many of the cultures in which mutation was induced became heterokaryotic through reverse mutation.

ALEXOPOULOS (C. J.). **Studies in antibiosis between bacteria and fungi. II. Species of Actinomyces inhibiting the growth of Colletotrichum gloeosporioides Penz. in culture.**—*Ohio J. Sci.*, xli, 6, pp. 425–430, 1941.

Continuing his investigations on the inhibition of fungal growth in culture by bacteria grown in association with fungi [*R.A.M.*, xviii, p. 129], the author grew *Colletotrichum gloeosporioides* (from diseased orange twigs from Greece) on a synthetic medium in Petri dishes, in the presence of each of 80 different [named] species of *Actinomyces* obtained from the Centraalbureau voor Schimmelcultures, Baarn.

The results obtained indicated that the growth of *C. gloeosporioides* was inhibited over a distance of 10 mm. or more by strong inhibitors (of which 14 were found, including *A. scabies*), less than 10 mm. by weak inhibitors (31), while non-inhibitors (35) exerted no effect. Filtrates from liquid cultures of representative species of the three groups were then used in preparing nutrient agar for *C. gloeosporioides*, and after 7 days' incubation the colonies of this fungus ranged from 18 to 34 mm. on medium prepared from the filtrate of strong inhibitors, compared with 62·5 mm. for the control; filtrates from weak or non-inhibitors were without effect.

Little doubt can be entertained that inhibition of fungal growth was due to some toxin manufactured in the medium by the Actinomycetes, and the difference between inhibitors and non-inhibitors may be due to the ability of some and the inability of other Actinomycetes to produce a substance toxic to the fungus. Various hypotheses regarding the action of the inhibitors are discussed.

An autotoxic substance similar to the toxin produced by the Actinomycete inhibitors cannot be postulated for *C. gloeosporioides* because two colonies of the fungus when grown in the same Petri dish merged.

WEINDLING (R.). **Experimental consideration of the mold toxins of Gliocladium and Trichoderma.**—*Phytopathology*, xxxi, 11, pp. 991–1003, 1 graph, 1941.

In the course of studies on the factors determining the production, stability, and activity of the crystalline toxin yielded by the mould *Gliocladium fimbriatum* [*R.A.M.*, xvii, p. 337], certain fungi that had given evidence of antagonism to *Rhizoctonia* [*Corticium*] *solani* in culture media were investigated with respect to the toxicity of their filtrates after two days' growth on a liquid glucose-peptone substratum at P_H 4·5. Potent filtrates were derived from *G. fimbriatum* and pigmented isolates of *Trichoderma* [? *viride*: ibid., xiv, p. 248], extraction being effected with lipoid solvents, of which chloroform (40 per cent. of volume of filtrate) was the most effective.

The gliotoxin is produced for the most part during the first 2½ days of

growth, at which period the toxicity of *G. fimbriatum* towards its competitors also reaches a maximum. The shaking-culture method of Kluyver and Perquin (*Biochem. Z.*, cclxvi, pp. 68–81, 1933), with certain modifications, notably in an increased velocity of 90 to 100 movements per minute, was found to expedite the life-cycle of the fungus, thereby facilitating the purification of the toxin by obviating the accumulation of other chloroform-soluble substances during protracted culture.

Satisfactory yields of gliotoxin were dependent on an abundance of oxygen and high acidity (P_H 5 and downwards). Ammonium salts were better sources of nitrogen than peptone or nitrates, while the best carbon supplies were obtained from glucose and sucrose, glycerine and levulose reducing output. Large-scale production of the toxin was carried out on non-sterilized media at P_H 2·5 to 3 in 3- or 6-l. flasks, the influence of contaminants being minimized during the brief growth period of three days by the high acidity of the substratum.

In relation to the germinating spores of *Sclerotinia americana* [*S. fructicola*] and *C. solani*, the fungicidal action of gliotoxin exceeds that of copper sulphate and falls below that of mercuric chloride.

In neutral and acid solutions the toxin remains stable for several weeks at room temperature, whereas increasing alkalinity induces a high degree of instability, the rate of decomposition likewise being accelerated by rising temperatures; at 37° C., for instance, samples of P_H 7·1 lost from $\frac{2}{3}$ to $\frac{3}{4}$ of their toxicity within 24 hours, while toxic solutions of P_H 2·4 are not affected by 30 minutes' exposure to 122°. Thermostability decreases with falling acidity, especially beyond P_H 5. The maximum amount of activity of gliotoxin in experiments with *C. solani*, was exerted at P_H 8·2, while at P_H 9·5 toxicity was lost immediately; the toxicity of the substance increased with rising temperatures in tests up to 32·5°.

Turner (W. I.) & Henry (V. M.). **Growing plants in nutrient solutions or scientifically controlled growth.**—xiii+154 pp., 19 figs. (3 col.), 8 diags., 2 graphs, New York, J. Wilby and Sons, Inc.; London, Chapman and Hall, Ltd., 1939. [Received December, 1941.] $3.

This well-illustrated manual, based largely on the first-named author's practical experience, supplemented by information drawn from the pioneer studies in this field of various American and Canadian experiment stations, contains full directions for the growth of plants in nutrient solutions, and includes several chapters of interest to phytopathologists, dealing, e.g., with the essential elements and their functions in plant development and the diagnosis of deficiency symptoms [*R.A.M.*, xxi, p. 42].

Sommer (Anna L.). **Mineral nutrition of plants.**—*Annu. Rev. Biochem.*, x, pp. 471–489, 1941.

Included in this survey of recent contributions to the study of the mineral nutrition of plants are a number of papers dealing with the pathological effects of deficiencies of various essential elements.

Hutchins (H. L.) & Lutman (B. F.). **Staining scab Actinomyces in Potato tuber tissues.**—*Stain Tech.*, xvi, 2, pp. 63–66, 1 fig., 1941.

Scab (*Actinomyces*) [*scabies*] hyphae embedded in the middle lamellae

of potato tuber cells were located in sections at the Vermont Agricultural Experiment Station by the use of a modified Gram staining technique [*R.A.M.*, xxi, p. 38] involving the following steps: (1) treatment with xylol, absolute alcohol, 95 per cent. alcohol, and then washing in water; (2) staining for 24 hours in a solution of 10 c.c. 95 per cent. alcohol, 2. c.c. aniline oil, 88 c.c. distilled water, and 5 gm. crystal violet; (3) washing in water to remove excess stain; (4) immersion in Gram's iodine solution for 24 hours; (5) washing in absolute alcohol until no more colour flows out of the sections; and (6) clearing in xylol, followed by mounting in Canada balsam dissolved in xylol.

Lutman (B. F.). **The reappearance of Potato scab in infested and its appearance in almost uninfested land.**—*Amer. Potato J.*, xviii, 3, pp. 65–80, 3 diags., 1941.

In 1935 a plot at the Vermont Agricultural Experiment Station utilized from 1914 to 1916 as a testing ground for potato varieties and known at that time to be infested by scab [*Actinomyces scabies*: *R.A.M.*, iii, p. 61] was replanted with disinfected Green Mountain seed and enriched with commercial fertilizer. During the intervening period the pathogen was presumed to have lost its virulence or died off, the percentage of badly scabbed tubers in susceptible varieties having declined from nearly 100 to 3·3 per cent. Of the apparently clean 70 per cent., however, many when freshly dug showed the typical pock marks of deep scab, which on drying merely presented the russet aspect typical of certain varieties. For the next five years the plot was again planted with Green Mountains for further investigations, and in 1938 the original site was extended threefold by the addition of wings of the same size to the north and south, on which no potatoes had been grown for 30 years. In that year's harvest, taken as a whole, the old plot produced only 13·2 per cent. clean tubers and the new wings 91·1 per cent., the percentages of badly scabbed tubers on the old and new land being 35·3 and 0·3, respectively. In 1939 the old plot yielded 59·7 per cent. badly and 35 per cent. slightly scabbed tubers, and the new ones 3·6 and 41·8 per cent., respectively, the corresponding figures for 1940 being 85 and 15 and 15 and 45, respectively.

No entirely convincing explanation of the recrudescence of scab on the old plot can be presented, but the spread of the pathogen to the virgin soil was presumably initiated by cultural practices and perpetuated by the gradual acclimatization of the organisms to their new habitat. Other conditions being equal, a high soil moisture content and capacity for moisture retention are the predominant factors in the promotion of scab activity in light sandy loam soils.

Holmberg (C.). **Potatiskräftans bekämpande och Potatissortfrågan. 2. Potatissortfrågan.** [Potato wart control and the question of Potato varieties. 2. The Potato variety question.]—*Landtmannen, Uppsala*, xxv, 10, pp. 195–198, 3 figs., 1941.

About 20 potato varieties immune from wart disease [*Synchytrium endobioticum*] are stated to be now in cultivation in the 54 'protected

areas' of Sweden [*R.A.M.*, xx, p. 378], the chief varieties being Dukker and Irish Cobbler in the early group, King George V, Majestic, Alpha, Arran Consul, and Ackersegen in the medium to late, and Parnassia and Voran in the fodder and industrial. The distinguishing characters of these and other less widely grown varieties are described, with notes on their adaptation to local conditions.

McLean (J. G.) & Walker (J. C.). **A comparison of Fusarium avenaceum, F. oxysporum, and F. solani var. eumartii in relation to Potato wilt in Wisconsin.**—*J. agric. Res.*, lxiii, 9, pp. 495–525, 5 figs., 3 graphs, 1941.

In a comparative study of the three wilt diseases of potato in Wisconsin, *F. oxysporum* [*R.A.M.*, xxi, p. 39], *F. solani* var. *eumartii* [loc. cit.], and *F. avenaceum* [ibid., xvii, p. 409], a strain of the last-named fungus isolated from diseased potato plants proved capable of producing infection and discoloration of the stems, stolons, roots, and tubers from which the fungus could be reisolated. The 12 single-spore isolates of this fungus tested produced three more or less distinct classes of infection. In both greenhouse and field inoculation experiments, *F. solani* var. *eumartii* produced the most severe type of wilt (particularly in Rural New Yorker variety, which together with Irish Cobbler was generally more susceptible to the wilt fungi than either Bliss Triumph or Katahdin), while the other two species, though differing in symptoms and temperature requirements for growth, were similar in the severity of disease, the percentages of infection, the time of appearance of foliage symptoms and the temperature most favourable for infection. In Wisconsin *F. solani* var. *eumartii* is confined largely to the north-eastern part of the State where it may infect 8 per cent. of the plants in the field, but it is not the serious problem that it is in some other parts. *F. oxysporum* and *F. avenaceum*, in equal proportions, are largely responsible for potato wilt in Wisconsin.

In field experiments, inoculation of seed pieces at planting time was used successfully with all three species, early planting of inoculated seed pieces resulting in a greater percentage of infection and more severely diseased tubers than did late planting. In the host tissue, the mycelia of *F. oxysporum* were closely confined to the xylem vessels of the stem; those of *F. avenaceum* occurred abundantly in both vascular and cortical tissues of the lower stem; and those of *F. solani* var. *eumartii* were most abundant in the stem cortex. All three pathogens showed rapid penetration of the roots. Heavy-walled xylem cells filled with a dense granular deposit and disintegration of certain cells of the phloem and xylem of the stem were associated with infection by all three species; abnormal effects in the host tissue in advance of fungal invasion was greatest in plants inoculated with *F. solani* var. *eumartii*.

Optimum growth of potato and of the strain of *F. avenaceum* used occurred at air temperatures between 20° and 24° C. A soil temperature of 28° was most favourable for infection of the potato plant. A moist soil with the water-holding capacity maintained at 50 per cent., was more conducive to infection than were either dry or wet soils with the moisture capacity at 30 or 70 per cent., respectively.

Infected plants at Starks, in the northern part of the State, displayed

symptoms not pronounced at Madison in southern Wisconsin, such as leaf-rolling, -reddening, and -rosetting, and the production of aerial tubers in the axils of the leaves. The greatest percentage of plants showing purple top resulted from inoculation with *F. avenaceum*, some from *F. oxysporum*, and only a few from *F. solani* var. *eumartii*.

Blodgett (F. M.). **A method for the determination of losses due to diseased or missing plants.**—*Amer. Potato J.*, xviii, 5, pp. 132–135, 1941.

Stewart (*Bulls. N.Y. St. agric. Exp. Sta.* 459, pp. 45-69, 1919; 489, pp. 1–52, 1921) and Livermore (*J. Amer. Soc. Agron.*, xix, pp. 857–895, 1927) have shown that in the case of potatoes, the adjacent hills on either side of a missing one make up about a quarter of the loss in yield of missing hills, or together the hills on both sides offset about half the reduction. This raises the question whether the low yield of a potato plant affected by a virus disease, e.g., leaf roll, may not be partially counterbalanced by adjoining healthy hills. Following up a suggestion by H. K. Fernow, an attempt (which is described and illustrated by hypothetical examples) has been made to work out a method for the determination of losses from diseased or missing plants by the classifications of the hills in a field into six classes, H(ealthy)HH, HD(iseased)H, DHH or HHD, DHD, DDH or HDD, and DDD, in relation to the effect of adjacent hills on the central one and the computation of the frequency of such classes in fields with varying disease percentages by a modification of the binomial distribution system.

Tuthill (C. S.) & Decker (P.). **Losses in yield caused by leaf roll of Potatoes.**—*Amer. Potato J.*, xviii, 5, pp. 136–139, 1941.

The method devised by Blodgett for the determination of the losses in yield caused by diseased or missing plants in rows of field potatoes [see preceding abstract] was applied to two varieties, Chippewa and Cobbler, affected by leaf roll to the extent of 35 and 23 per cent., respectively, on peat soil near Elba, New York. It was found that the healthy hills bordered by diseased ones on one or both sides partially compensated for the reduction in yield due to infection. Since the yield varies with changes in the percentage of diseased plants, the binomial distribution may be used to estimate the frequency with which healthy plants will occur with those affected by leaf roll on one or both sides. There is thus a basis for the computation of loss in yield for any percentage of disease by ascertaining the output of the central plants in the six classes differentiated. The method under trial would appear to be equally well adapted to statistical studies on other tuber-transmissible diseases.

Yoshii (H.). **Studies on the nature of Rice blast resistance. I. The effect of silicic acid to the resistance. II. The effect of combined use of silicic acid and nitrogenous manure to the toughness of the leaf blade of Rice and its resistance to Rice blast. III. Relation between Rice blast resistance and some physical and chemical properties of the different portions of the leaf blade of Rice.**—*Bull. sci. Fak. terk. Kjûsu Univ.*, ix, 3, pp. 277–307, 1941. [Japanese, with English summaries.]

In the writer's fully tabulated studies to determine the relation of

the toughness of the leaf blade and its silica content to the susceptibility to rice blast (*Piricularia oryzae*) [*R.A.M.*, xix, p. 429] of plants grown in Kasugai's solution made up with tap water containing 13·3 mgm. silicic acid per l., the cultures were divided into four series and supplied with 0, 50, 250, and 500 mg. silicic acid per l., respectively. The toughness of the leaf blade was measured by the needle puncture method, using Joly's balance, at the motor cell region of the inner half of the blade, the resulting data being expressed in gm. weight per sq. mm. By these means it was ascertained that the resistance of the leaf blade to *P. oryzae* and its silica content, but not its toughness, increase in proportion to the quantity of silicic acid supplied.

The application of silicic acid to the soil was shown to enhance the resistance of rice to blast, while foliar toughness, measured by the needle puncture or tearing method, varied in inverse proportion to the amount of nitrogenous manure given. Where the latter factor is maintained at a uniform level, the percentage of silica in the leaves of plants receiving silicic acid exceeds that in the foliage of plants from which this element was withheld. Under similar conditions, the toughness of the leaves of plants to which silicic acid is applied is less than that of the untreated series.

The toughness and the percentages of silica and nitrogen were measured in the apical, middle, and basal regions of rice leaf blades, two resistant varieties, Sensyō and Aikoku, and three susceptible, Asahi, Ban-Shinriki, and Kamairazu, being included in the tests for toughness, while Totigi-Wase and Tōgō were used in the ripening stage for the silica and nitrogen determinations. The resistance of the leaf blade to needle puncture was found to be highest at the base and lowest near the tip, while the percentages of silica and nitrogen were largest in the apical and basal regions, respectively. Comparing these data with those secured by T. Abe [ibid., xvii, p. 767], it is apparent that the susceptibility of rice leaves to blast is proportionate to the amount of nitrogen and inversely proportionate to that of silica in the blades, but that little or no connexion exists between reaction to *P. oryzae* and the toughness of a given area of the leaf.

Nakata (K.) & Takimoto (S.). **A ring strain of Tobacco common mosaic found on the Pepper.**—*Bull. sci. Fak. terk. Kyûsu Univ.*, ix, 2, pp. 178–189, 14 figs., 1940. [Japanese, with English summary.]

A ring strain of mosaic observed on the Sisi-togarasi [chilli] pepper variety in nature produces a large, bright yellow mottling on the leaves, and in inoculation experiments the Nikko and Takanotume varieties likewise reacted by distinct ring or mottle patterns, while in the case of Yatuhusa and Okinawazairai primary local necrotic spots were formed on the inoculated leaves and those produced subsequently were normal. Primary necrotic lesions also developed on the inoculated foliage of *Datura stramonium*, *Nicotiana glutinosa*, *N. repanda*, and *N. longiflora*, a bright yellow mottling on the young leaves of two or three other Solanaceae, and distinct rings on tobacco, *N. glauca*, and *Solanum sisymbrifolium*. The virus retains its infectivity at 1:100,000 but not at 1 in 1,000,000, and is inactivated by ten minutes' exposure to 90° C. The virus is considered to be a distinct strain of tobacco mosaic (*Nico-*

tiana virus 1) [*R.A.M.*, xx, p. 402], characterized by the production of definite rings on tobacco and a yellow mottling on *Physalis angulata* and *S. nigrum*.

COCHRAN (H. L.). **Better methods of Pimiento production.**—*Bull. Ga Exp. Sta.* 218, 41 pp., 27 figs., 1941.

The section on diseases (pp. 27–39) of pimiento [chilli] and their control in Georgia is an abridgement of a paper by B. B. Higgins entitled 'Important diseases of Pepper in Georgia', reference to which has already been made [*R.A.M.*, xiv, p. 344].

SAINT (S. J.). **Report on the work of the Department of Science and Agriculture, Barbados, for the year ending 31st March, 1940.**—14 pp., [1941].

During the period under review, routine inspections of the sugar-cane crop in Barbados were carried out until the growth made adequate inspection for mosaic [*R.A.M.*, xix, p. 494] no longer possible. Heavy infection was discovered in the tenantries at Cleavers Hill, St. Elizabeth's Village, St. Joseph and Workman's tenantry, St. George, and these localities, together with Orange Hill Tenantry, St. James, were added to the 'Proclaimed Infected' areas. During the planting season, growers in the 'proclaimed infected' districts were supplied with mosaic-free cane as usual, the resistant B. 35187 variety being distributed wherever possible.

RAMAKRISHNAN (T. S.). **Top rot ('twisted top' or 'pokkah bong') of Sugarcane, Sorghum, and Cumbu.**—*Curr. Sci.*, x, 9, pp. 406–408, 2 figs., 1941.

In 1940, at the Coimbatore Agricultural College and Research Institute, *Fusarium moniliforme* [*Gibberella fujikuroi*] was isolated from the tissues of sugar-cane affected by top rot [*R.A.M.*, xix, p. 583], sorghum showing symptoms of twisted top [ibid., xiv, p. 472], and *Pennisetum typhoides* suffering from a similar disorder. The upper leaves of the diseased sorghum plants were linked together, forming a series of arches, the tips of the younger leaves being rolled inside those of the older ones; the upper nodes were shortened, and earheads were usually abortive. The three isolates were grown on French bean and Quaker oats agars and steamed rice, the two last-named media being coloured varying shades of purple by the growth of the organisms. Cross-inoculation experiments with the three strains of the fungus gave positive results on all the above-mentioned hosts, but not on rice. The differences between the sorghum disease of Coimbatore and the twisted top of sugar-cane in Cuba, said to be caused by mechanical friction [ibid., viii, p. 670], are briefly discussed: the latter occurs more severely in dry periods and is not associated with rotting, whereas the former develops only during the rainy months and is accompanied by discoloration and rotting. Moreover, *G. fujikuroi* is consistently present in the diseased sorghum, while both in this host and in *P. typhoides* the symptoms are more akin to those of 'pokkah-boeng', caused by *G. fujikuroi*.

RAMAKRISHNAN (T. S.). **Studies in the genus Colletotrichum. II. Physiological studies on Colletotrichum falcatum Went.**—*Proc. Indian Acad. Sci.*, Sect. B, xiv, 4, pp. 395–411, 1 pl., 2 figs., 1941.

Continuing his studies on the genus *Colletotrichum* [*R.A.M.*, xx, p. 317] at the Coimbatore Agricultural Research Institute, the writer made a series of observations on the development in pure culture of *C. falcatum*, isolated from Poovan sugar-cane in Madras [ibid., xix, p. 259]. The pathogen grows well on a number of standard media, including French bean, Quaker oats, and Richards's agars, the optimum hydrogen-ion concentration and temperature for its development being P_H 4·5 to 5 and 32° C., respectively. The average spore length ranged from 19·9 μ to 27·6 μ (the normal size) at 15° and 30°, respectively. The spores are destroyed by five minutes' exposure to a temperature of 51°. Sucrose was found to be the best source of carbon, while nitrogen is most readily assimilated from asparagin, potassium nitrate, and peptone, the maximum amount of growth being made at a carbon-nitrogen ratio of 5:1. On a medium supplying ammonium sulphate as the nitrogen source the spores produced show a bulge in the middle or are otherwise malformed, whilst on one supplying asparagin the spores are shorter than on a potassium nitrate medium.

A pale-coloured saltant, developing on Richards's agar, differed in certain respects from the dark parent race [ibid., xx, p. 228]: for instance, its maximum virulence was exerted in inoculation experiments at 34° instead of 30°, it attacked the Co. 213 variety less, and Co. 421 more, severely than the dark parent, and the growth of the mutant was scantier at the optimum temperature than that of the original dark race. The pale saltant further proved to be more resistant than the dark race to the encroachment of *Trichoderma lignorum* [*T. viride*] in paired cultures, and there were also variations in the extent of enzyme production, the dark race yielding more diastase and pectinase and the light one more trypsin, amidase, and erepsin; the latter, moreover, forms small quantities of emulsin, which is not produced by the parent.

WATERSTON (J. M.). **Observations on parasitism of Rosellinia pepo Pat.**—*Trop. Agriculture, Trin.*, xviii, 9, pp. 174–184, 10 figs., 2 diags., 1941.

Rosellinia spp. causing root disease in the West Indies [*R.A.M.*, xiv, p. 84] are stated to be confined to *R. bunodes*, which was isolated from *Hibiscus rosa-sinensis* and grapefruit from Grenada and from arrowroot from St. Vincent, and *R. pepo*, isolated from cacao in Trinidad and Grenada and from nutmeg in Grenada, while *R. paraguayensis* was found on only one occasion on a badly pruned branch of an otherwise healthy cacao tree and is not considered to be parasitic. No perfect stage of *R. pepo* was observed, whereas perithecia of *R. bunodes* were abundant. The rarely produced perithecial stage is stated to be the main character distinguishing *R. pepo* from *R. paraguayensis*, while the following differences exist between the former fungus and *R. bunodes*: in *R. pepo* the mycelial fan encircling the collar of the stem is brown or purplish black with an olive-green tint; on the roots the fungus produces loose, cobweb-like strands, at first smoky grey, later black and coalescing

into a carbonaceous mass with a woolly or glossy felt-like surface; in the tissues it forms white irregular strands in the cortex, white fans or star-like webs in the cambium, no strands, but thin plates appearing in cross section as black zig-zag lines in the wood, and firm, round, buff-coloured strands with a white centre in the herbaceous stems. In *R. bunodes* the mycelial sheet encircling the collar is white at first, later purplish-black; on roots the mycelium appears as closely applied, firm, black, branching strands with thicker irregular knots; in the tissues *R. bunodes* forms cylindrical strands, black outside and white inside the cortex, black thread-like strands on the surface of the wood, colourless mycelium and later black strands within the wood, and round, black strands in the herbaceous stems. On 2 per cent. malt agar, colonies of *R. pepo* are dark brown and glossy at first, later woolly and olive green, the white mycelial strands turning black with age, while the colonies of *R. bunodes* are white and woolly at first, later turning buff-coloured, the mycelial strands being black.

Rosellinia attacks were observed in two widely different types of area: in regions of high rainfall and little sunshine, with abundant humus, the fungus spreads without restriction, either living saprophytically on decaying leaf mould or acting as a dangerous although incidental parasite; in regions with low rainfall, absence of shade trees, and poor humus formation, the spread of the fungus is slow and confined to roots of susceptible hosts. The list of hosts of *R. pepo* comprises 16 species. This fungus is stated to have a more restricted range and geographical distribution than *R. bunodes*. Field and laboratory observations showed that hydrogen-ion concentration, amount of nitrogen, organic matter, available potash and phosphate, and the rate of nitrification in the soil within or adjacent to disease patches had no relation to the incidence of *R. pepo* in cacao estates. A deficiency in available phosphate (below 40 p.p.m.) was, however, common to all disease patches. Field evidence indicated that *R. pepo* preferred soils of light texture, and it was shown experimentally that the rate of infection of cacao seedlings was most rapid in the drier and better aerated series. The pathogenicity of *R. pepo* to both young and mature cacao trees was demonstrated by inoculation experiments in the field as well as in the laboratory, and it is concluded that the fungus is a primary parasite of cacao.

Sydow (H.). **Fungi aequatorienses. (Series prima.)** [Ecuadorian fungi. (First series.)]—*Ann. mycol., Berl.*, xxxvii, 4–5, pp. 275–438, 1939. [Received January, 1942.]

This critically annotated list of fungi (including a number of new species) collected by the author on the occasion of a six months' visit to Ecuador commencing in August, 1937, is preceded by a foreword describing the climatic, topographical, and ecological features of the country in relation to its fungus flora, and by a five-page bibliography of papers dealing with the latter. The following are among the species of economic importance listed: *Uromyces janiphae* on cassava, *Puccinia maydis* on maize, *Tranzschelia* [*P.*] *pruni-spinosae* on *Prunus capula* var. *salicifolia*, *Phyllachora gratissima* on avocado [*R.A.M.*, xxi, p. 99], *Mycosphaerella brassicicola* on cabbage, *Aphanopeltis aequatoriensis*

n.sp. on *Pithecolobium* [*Samanea*] cf. *saman*, *Asperisporum caricae* on papaw [ibid., xxi, p. 88], and *Cercospora nicotianae* on tobacco.

Sydow (H.) & Ahmad (S.). **Fungi panjabenses.** [Punjab fungi.]—*Ann. mycol., Berl.*, xxxvii, 4–5, pp. 439–447, 1939. [Received January, 1942.]

Included in this critically annotated list of fungi (comprising a relatively large number of smuts) collected by the junior author in the plains of the Punjab are a new genus (*Ahmadia*) and eight new species.

Thom (C.) & Raper (K. B.). **The Aspergillus glaucus group.**—*Misc. Publ. U.S. Dep. Agric.* 426, 46 pp., 14 figs., 1941.

A study embracing comparative culture and microscopic examination of strains of the *Aspergillus glaucus* group in the authors' collection (made over a period of 35 years) [*R.A.M.*, v, p. 700], supplemented by strains and groups of strains from numerous other sources, enabled all these strains to be brought together into a series of aggregate species, each characterized by the production of ascospores within a particular size range and bearing typical markings.

The species aggregates recognized are *A. repens*, *A. ruber*, *A. chevalieri*, *A. amstelodami*, *A. minor*, *A. umbrosus*, *A. echinulatus*, *A. medius*, *A. carnoyi*, and *A. niveo-glaucus* n.sp., for each of which a type is described. The additional species and varieties recognized are *A. pseudoglaucus*, *A. chevalieri* var. *intermedius*, n. var., and *A. montevidensis*, within the *A. repens*, *A. chevalieri*, and *A. amstelodami* aggregates, respectively. The usages represented by strains received under particular names in culture are tabulated to show their place in the arrangement of species proposed. Forms showing the ascospores of a series, but differing in colony morphology and details of activity, are regarded as variants, not taxonomic varieties.

In the course of a discussion on variation in this group the authors report observations on type cultures of B. Barnes's mutants of *Eurotium herbariorum* [ibid., viii, p. 192]. They identify the original normal strain as *A. amstelodami*, and four of the 'variants' as *A. ruber*, *A. repens*, *A. chevalieri* var. *intermedius*, and *A. ustus*, and suggest that they may have appeared in Barnes's cultures as contaminations. A fifth variant is of the *Cladosarum* type. It is suggested that Yuill's genus *Cladosarum* represents a monster type unlikely to survive in nature, and that it is therefore doubtful whether generic designation is warranted.

Petch (T.). **Further notes on British Hypocreales.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 166–178, 1941.

In this paper the author adds 27 species in 15 genera to his list of British Hypocreales [*R.A.M.*, xvii, p. 772]. He points out that Tulasne first found his *Nectria ditissima* on beech, and stated that it was *N. coccinea*, and that to it belonged at least in part the *Sphaeria coccinea* of most mycological writers. Phillips and Plowright recorded *N. ditissima* in New and Rare British Fungi, No. 154, March, 1880, but Plowright's paintings of the fungus on canker in apple trees, now in Herb. Brit. Mus., are of *Dialonectria galligena*.

A specimen of *D. galligena* on ash was received by the author from Wells, Somerset (April, 1938).

Only one British specimen of *Gibberella zeae* [usually known by plant pathologists as *G. saubinetii*: ibid., xiii, p. 154; xix, p. 117] (on grains of wheat) was cited in the author's first paper. In Grove's herbarium there is a specimen on the culm of an undetermined grass. Probably the fungus is not uncommon on native grasses. Specimens have been received on *Phragmites* (Norfolk, 1939).

Blackwell (E[lizabeth] M.), Waterhouse (G[race] M.), & Thompson (M. V.). **The invalidity of the genus Pythiomorpha.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 148–165, 2 figs., 1941.

A detailed study of a strain of '*Pythiomorpha gonapodyides*' found on an apple that had been dropped into a pond revealed its identity in pure culture with *Phytophthora megasperma*. A survey of the descriptions of different forms and species of *Pythiomorpha* recorded between 1909 and 1936 showed that each would answer to a species of *Phytophthora* growing in water. The descriptions of the original species, *Pythiomorpha gonapodyides*, varied widely enough to suggest they might apply to more than one species of *Phytophthora*. Investigation of the features claimed as diagnostic for the genus *Pythiomorpha* (proliferating sporangia, emission of zoospores within a vesicle, irregular hyphae, cellulin grains, absence of conidia, diplanetic zoospores, and aquatic habitat) showed that all of these were equally characters of the Pythiaceae as a whole and all are present in *Phytophthora megasperma* (except the variable cellulin grains). There are, therefore, no grounds for retaining the genus *Pythiomorpha*. The recommendation is made that no further species of *Pythiomorpha* should be erected. The five species already described should be re-examined, and if not found to be known species of *Phytophthora* (or *Pythium*) should be incorporated as new species into one or other of these genera.

Marudarajan (D.). **Observations on the production of sexual organs in paired cultures of Phytophthora species of the palmivora group.**—*Proc. Indian Acad. Sci.*, Sect. B, xiv, 4, pp. 384–389, 1 pl., 1941.

At the Agricultural Research Institute, Coimbatore, the author studied the production of oospores in paired cultures on standard media at 20° C. of three isolates of *Phytophthora palmivora* from *Borassus flabellifer*, coco-nut, and orange, respectively, and one each of *P. arecae* from areca palm, *P. faberi* [*P. palmivora*] from cacao, and *P. meadii* from rubber. *P. arecae* formed oospores in combination with *P. meadii* and *P. palmivora* (all strains) and thus falls into Gadd's 'rubber group' of *P. palmivora*, while *P. meadii* behaves as a member of the 'cacao group' [*R.A.M.*, vi, p. 608] thereby invalidating Ashby's tentative relegation of *P. arecae* and *P. meadii* to a single species [*P. arecae*] separable by their mode of development in culture into two groups of strains, *arecae* and *meadii* [ibid., ix, p. 272]. The formation of oospores in mixed cultures of *P. arecae* with *P. meadii* or any of the members of the cacao group affords additional grounds for merging all these isolates as strains of *P. palmivora*, as suggested by Tucker [ibid., x, p. 755].

AINSWORTH (G. C.). **A method for characterizing smut fungi exemplified by some British species.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 141–147, 1941.

A description is given of a shorthand method devised by the author for recording the principal characters of the smut fungi. It consists in a numerical formula in which the first four numerals (A) represent macroscopic characters (or characters that require only supplementary microscopic examination), the second four (B) microscopic characters, and the third four (C) measurements, the requisite numeral for each character being selected by reference to a given table. The four numerals in A represent, respectively, the position, covering, and internal structure of the sorus, and the macroscopic appearance of the spore mass; those in B, the microscopic appearance of the spore mass, whether the spores are single, in pairs, or in balls, spore ornamentation, and spore coloration; while the C figures represent, respectively, the mean maximum spore diameter in μ, the mean maximum spore-ball diameter in μ, the mean sorus length in cm., and the mean maximum diameter of sterile cells, sterile spores, cells of false membrane, sterile cortical cells of spore ball, or conidia of an *Entyloma* in μ. A table is given showing the numeral to be selected for each character and the application of the formula to *Sphacelotheca cruenta* and *S. sorghi* is explained. These species are represented by the formulae 1112·2102·2014 and 1112·½102·1012, respectively. Formulae for 45 British smuts are appended.

SIMURA (T.). **Further studies on the resistance to brown blight in Tea plants.**—*Jap. J. Genet.*, xvi, 5, pp. 246–256, 8 graphs, 1940. [Japanese, with English summary.]

Analyses of the leaves of tea plants giving varying reactions to infection with the brown blight fungus (*Guignardia camelliae*) [*R.A.M.*, xix, p. 45] showed that resistant types contained more tannin and less nitrogen than susceptible types. As was to be expected from these relationships, the growth of the pathogen was to a great extent inhibited in Hopkins's medium prepared with juice from the leaves of resistant varieties, whereas a stimulus to its development was afforded by the foliar extract from susceptible sorts. Caffein, like tannin, tended to retard the growth of *G. camelliae*, but the amount of the former substance in tea leaves is relatively small.

ALLINGTON (W. B.). **Observations on the epidemiology of Tobacco wildfire and blackfire.**—*Phytopathology*, xxxi, 10, pp. 957–959, 1 fig., 1941.

In recent tests at the Wisconsin Agricultural Experiment Station, light was found to be an important factor in the development of physiological water-soaking of tobacco plants, which has been shown to provide a suitable condition for infection by the wildfire and blackfire organisms (*Bacterium tabacum* and *Bact. angulatum*) [*R.A.M.*, xvii, p. 205]. Thus, plants grown in a sandy soil in the greenhouse and transferred to a moisture-laden atmosphere developed typical and profuse foliar water-soaking in darkness or subdued light, higher intensities of which, on the other hand, prevented the occurrence of

the condition under comparable temperature and humidity conditions. Both pathogens have been found to survive for periods up to six months in the leaves of the atypical hosts lucerne, bean (*Phaseolus vulgaris*), *Ambrosia bidentata*, and *Chenopodium album*, as well as in tobacco itself, so that the organisms could overwinter and be disseminated in such material.

ELROD (R. P.) & BRAUN (A. C.). **A phytopathogenic bacterium fatal to laboratory animals.**—*Science*, N.S., xciv, 2448, pp. 520–521, 1941.

Phytomonas polycolor, the agent of a tobacco leaf spot in the Philippines [*R.A.M.*, x, p. 133], has been found by the authors to be extremely virulent when injected into laboratory animals, mice and guinea-pigs dying within 12 and rabbits in 24 hours. The evidence so far available indicates that the organism is probably the same as *Pseudomonas aeruginosa* (Schroeter) Migula.

HENDERSON (R. G.). **Treatment of Tobacco plant bed soil with nitrogenous fertilizers.**—*Agric. News Lett.*, *1941*, 9, pp. 72–78, 1941. [Abs. in *Chem. Abstr.*, xxxv, 22, p. 8187, 1941.]

In connexion with an experimental project on the response of tobacco seed-beds to nitrogenous fertilizers, evidence was secured that the agent of black root rot, *Thielaviopsis basicola*, can be effectively combated by the application of urea to the soil at the rate of ½ lb. per sq. yd.

MCCLEAN (A. P. D.). **Some leaf-curl diseases in South Africa. (i) Leaf-curl disease of Tobacco. (ii) A new 'Petunia'-strain of leaf-curl and a note on the occurrence of a leaf-curl disease of Hollyhock.**—*Sci. Bull. Dep. Agric. S. Afr.* 225, 72 pp., 14 pl., 1 fig., 1940.

Leaf curl of tobacco [*R.A.M.*, xix, p. 196] is stated to be now recorded in most parts of Africa where this crop is grown. In the present studies, commenced at the Natal Herbarium in 1931, the disease was transmitted by means of white fly, *Trialeurodes natalensis*, to tobacco, *Datura stramonium*, tomato, currant tomato (*Lycopersicum pimpinellifolium*), *Nicotiana glutinosa*, *Nicandra physaloides*, and possibly also to *Physalis peruviana*, *Helichrysum monstrosum*, and *Zinnia elegans*. It was also transmitted by grafting between tobacco and various Solanaceous hosts, but not by mechanical inoculation or through the seed of tobacco or *D. stramonium*. During the process of transmission of the virus from plants with severe leaf curl, apparently weaker strains of virus arose, which produced milder symptoms on tobacco and other hosts. These new strains were designated as mild and latent, of which 7 and 17, respectively, were isolated; the former were distinguished by their ability to produce enations, whilst the latter are incapable of causing any thickening or enations on the leaves of tobacco. Two main types of reaction were found associated with the typical or severe form of leaf curl disease, their extent varying with the different hosts. The first response of tobacco is the development of a brilliant yellow network on the upper surface of the young leaves coinciding with the veins, and is formed by partial chlorosis as a preliminary response to

invasion by the virus. It appears to correspond with clearing of the veins and is highly diagnostic. The second type of reaction, developing to the greatest extent in tobacco, leads to the formation of enations, which either take the form of small, dark green, thickened areas or of comparatively large leafy outgrowths on the veins of the lower surface of the leaves. Of the anatomical changes in the leaf associated with the disease, the more important are hyperplasia in the pericycle and the development of palisade tissue towards the lower surface.

A new form of leaf curl was observed in 1939 on petunias in the Durban Botanical Gardens [ibid., xx, p. 150]. It was transmitted by grafting to tobacco, *Nicotiana glutinosa*, tomato, and petunia. It was readily distinguished from the leaf curl in tobacco, the main points of difference being the failure to induce a yellow network or any form of chlorosis in the early stages of infection in all the above-mentioned hosts; the continuous type of enations on tobacco leaves; the excessive distortion of tobacco leaves; the well-marked enations on *N. glutinosa* and tomato; the development of petal-like outgrowths on the corolla tube of petunias; and failure to infect *Datura stramonium*.

During the same year a leaf curl disease was also observed in hollyhock at Durban [loc. cit.], but no transmission trials were made and the relationship of this disease to other forms of leaf curl is not known.

McKinney (H. H.). **Virus antagonism, host resistance, and the acquired-immunity concept with reference to plants.**—*Phytopathology*, xxxi, 11, pp. 1059–1061, 1941.

The writer's studies on tobacco ring spot have confirmed Valleau's conclusion that affected plants do not outgrow the disease [*R.A.M.*, xx, p. 600], which merely passes from the acute phase, represented by ring spots, lesions, and oak leaf patterns, to a less apparent chronic condition in the subsequently invaded leaves. The infected plants, as in Valleau's experiments, gave poor yields, but the diffuse chlorosis observed by him at low temperatures, and a mottled and necrotic spot form of the same reaction, developed only in the growing leaves of certain varieties provided with ample quantities of fertile soil. The persistence of acute symptoms was shown to be favoured by the application of large amounts of virus to the developing leaves of plants that have entered the period of maximum growth rate. In some early-maturing selections treated in this way up to 70 per cent. of the plants manifested acute symptoms in all the leaves appearing after the onset of the disease, whereas in young seedlings inoculated before the rapid growth phase, only one to four leaves ordinarily showed acute signs of disease, and few or no local or systemic symptoms developed when the virus was wiped on slow-growing foliage with a thick, leathery texture.

The term 'acquired immunity' is thought to have been widely misinterpreted of recent years, and in connexion with Price's three types of this phenomenon, viz., chronic disease, carrier, and sterile [ibid., xx, p. 74], it is proposed that the third only be retained, at any rate by phytopathologists, for those cases in which a given virus or other infectious agent is incapable of multiplication in a plant. Symptomless carriers and mild reactors represent degrees of resistance,

tolerance, or susceptibility, because it is highly improbable that carriers are entirely free from symptoms.

Kassanis (B.) & Sheffield (F. M. L.). **Variations in the cytoplasmic inclusions induced by three strains of Tobacco mosaic virus.**—*Ann. appl. Biol.*, xxviii, 4, pp. 360–367, 2 pl., 1941.

Several new types of cytoplasmic inclusions were observed at Rothamsted in 1940 and 1941 in glass-house tobacco, tomato, and *Solanum nodiflorum* plants infected with each of three strains of tobacco mosaic virus: the ordinary tobacco mosaic, aucuba, and enation mosaic viruses [cf. *R.A.M.*, xxi, p. 61]. The new forms, mostly fibrous, included spindle-shaped bodies, masses of short needle-like fibres, and extremely long fibrous coils. The spike-like body, which had not been noted for a number of years, was again observed, and new amorphous forms were also found. All these arose either directly or from pre-existing inclusions of types previously recorded. The observed variations are not considered to be due to mutation of the virus strain, as almost identical results were obtained from all three strains. The type of inclusion produced appears to be to some slight extent determined by the host plant, but chiefly influenced by the amount of light and heat available to the host.

Cohen (S. S.). **Separation of Tobacco necrosis virus and Tobacco mosaic virus.**—*Proc. Soc. exp. Biol., N.Y.*, xlviii, 1, pp. 163–167, 2 graphs, 1941.

In the course of a study on the properties of the tobacco necrosis virus, occasional batches of Turkish tobacco plants were encountered which showed not only the non-systemic symptoms of necrosis on the lower inoculated leaves, but also through contamination those of systemic mosaic infection. Since the yield of the tobacco mosaic virus may amount to 2 to 3 mg. per c.c. juice [*R.A.M.*, xvii, p. 206], or over 100 times that of tobacco necrosis, which averages, according to unpublished data by Cohen and Stanley, 0·02 mg. per c.c., it was considered advisable to attempt the removal of the former.

This was effected by differential centrifugation with electrophoresis and by absorption with rabbit serum, precise descriptions of the methods used being given.

Spencer (E. L.). **Influence of nitrogen supply on the rate of multiplication of Tobacco-mosaic virus.**—*Plant Physiol.*, xvi, 4, pp. 663–675, 1 fig., 2 graphs, 1941.

Further studies on the influence of nitrogen supply on tobacco mosaic virus in Turkish tobacco plants [*R.A.M.*, xx, p. 498], in which the plants (grown in sand) were supplied with nutrient solutions containing low, medium, and high amounts of nitrogen, showed that in young plants a difference in virus activity became apparent on the 5th day after inoculation. The juice expressed from low-nitrogen plants was only about 35 per cent. as active as that from those receiving more nitrogen; on the eighth day the figure was less than 25 per cent. By this latter date, the juice from the high-nitrogen plants contained 12 times more virus than that from the low-nitrogen plants, though the

former were only two or three times the size of the latter. From the 4th to the 12th day after inoculation, the virus-protein content of the juice expressed from the low-nitrogen plants increased about 20 times, while that of the juice from the high-nitrogen plants increased over 200 times.

Older affected plants given the medium-nitrogen solution for longer periods before receiving the high-nitrogen solution showed greater virus activity as a result of the extra supply of nitrogen. The evidence indicated that the larger the plant the longer the time taken for the increased nitrogen supply to become effective.

The evidence obtained is considered to support the view that the increased virus activity associated with increased nitrogen supply was due primarily to an increase in the rate of virus multiplication in the high-nitrogen plants and slightly, if at all, to the partial inactivation of the virus in the low-nitrogen plants. Increase in the rate of virus multiplication appeared to be correlated with the nitrogen supply itself, and not directly with a growth differential resulting from the nitrogen treatment. Possibly, even in small plants there may be only a limited supply of available nitrogen. In such cases, as with larger plants, the competition for the available nitrogen between the normal growth processes and those responsible for virus formation may be a limiting factor in virus multiplication.

NAKATA (K.) & TAKIMOTO (S.). **Studies on the 'yellow Tobacco mosaic' or 'aucuba mosaic' of Tomato.**—*Bull. sci. Fak. terk. Kyûsu Univ.*, ix, 2, pp. 167–178, 1 col. pl., 10 figs., 1940. [Japanese, with English summary.]

The disease known as 'yellow tobacco mosaic' was experimentally shown to induce the same symptoms in tomato as aucuba mosaic, while the various properties of the virus under observation also coincide with those of *Nicotiana* virus 1c [tobacco virus 6]. Primary local lesions developed on inoculated leaves of *Datura stramonium*, *Nicotiana glutinosa*, and *N. sanderae*, while the new foliage of numerous other Solanaceae responded by yellow mottling. The aucuba mosaic virus proved to be very resistant to high temperature and chemicals, retaining its virulence for over a year in test tubes.

RICHARDSON (L. T.). **A Phytophthora Tomato disease new to Ontario.**—*Canad. J. Res.*, Sect. C, xix, 11, pp. 446–483, 17 figs., 4 graphs, 1941.

Since 1937, tomatoes growing under glass in central Ontario have been severely affected by a damping-off of seedlings and a rot of stems, fruits, leaves, and roots caused by *Phytophthora parasitica* [cf. *R.A.M.*, xx, pp. 324, 501]. One outdoor crop in the same locality has also been affected, and in 1940 the disease was reported from the Okanagan Valley, British Columbia. Seedlings may be killed before, during, or after emergence, and 50 per cent. in a flat may succumb in one day. In older plants grown indoors the symptoms consist of collar rot, stem girdle, or stem canker. On staked greenhouse plants the lesions are always within a foot of the ground. Fruits near the ground develop

lesions having a dark brown centre surrounded by an advancing zone with a greyish, water-soaked appearance. Roots grown in infected soil show rotted portions with mycelium within the tissues.

On oatmeal agar the fungus formed sporangia and chlamydospores, and on the roots of an artificially inoculated tomato seedling, oogonia and oospores; full descriptions of these organs are given.

The minimum, maximum, and optimum growth temperatures of the fungus on oatmeal agar were, respectively, about 12°, 32·5°, and 26° to 32·5° C., but on maize meal agar the optimum was 18° to 21°. No aerial growth took place at relative humidities under 80 per cent. Above this figure, colony size increased with increasing humidity up to saturation. Growth was possible at P_H 3·5 and 9·5, while maximum growth occurred (under the conditions of the experiment) at P_H 5.

Experimental evidence further demonstrated that infection was favoured by high atmospheric temperature and high relative humidity. Incidence varied directly with soil moisture content, and reached a maximum at soil temperatures in the vicinity of 22°. The ability of the fungus to establish itself in a soil depends upon the type of soil, the other micro-organisms present, and the substrate available for saprophytic development. Invasion of non-infested soils was retarded by the competitive factor and accelerated by the presence of living roots of tomato seedlings. The activity of the pathogen was suppressed by the addition of soy-bean residue to infested soil.

Natural infection was observed only on tomatoes, but inoculation tests revealed a wide range of potential hosts, almost all belonging to the Solanaceae. Over 40 commercial tomato varieties showed complete susceptibility to stem infection. A number of species of *Lycopersicum* were susceptible in the leaves, but the stems of some were resistant. The reaction of various Solanaceae and other plants is also given.

Control consists in the development of resistant tomato varieties, improved sanitation, crop rotation, and soil disinfection.

KAWAMURA (E.). **Bacteriophage of Bacterium solanacearum.**—*Bull. sci. Fak. terk. Kyûsu Univ.*, ix, 2, pp. 148–156, 1 pl., 1940. [Japanese, with English summary.]

A bacteriophage of high potency was isolated by 15 successive filtrations from a culture on potato dextrose solution of *Bacterium solanacearum* [*R.A.M.*, xvii, p. 303], which inhibited the growth of the pathogen at a dilution of 10^{-10}, its action being restricted, however, to the particular culture of the organism from which it was derived. Tomato plants were experimentally protected against the bacterial wilt by the incorporation of the bacteriophage in the soil. Two distinct strains of the bacterium were recognized, one forming circular, homogeneous colonies on potato agar and not liquefying gelatine, and the other developing irregular, fluid, non-homogeneous colonies and liquefying gelatine, the presence of the bacteriophage being confined to the latter type. The homogeneous strains of *Bact. solanacearum* developed in old cultures of the fluid type or those enriched with the bacteriophage, as well as in the lesions on tomato plants inoculated with the fluid strain, whence it is inferred that the latter may be a variation induced by the action of the bacteriophage.

Israilski (W. P.) & Artemieva (Mme S. S.). **Serologische Untersuchungen der durch die Bakteriose befallenen Pflanzen. III. Untersuchungen der Tomaten auf Aplanobacter michiganense.** [Serological studies on plants attacked by bacteriosis. III. Examination of Tomatoes for *Aplanobacter michiganense*.]—*Микробиол.* [*Microbiol.*], x, pp. 74–80, 1941. [Abs. in *Chem. Zbl.*, cxii (ii), 19, p. 2335, 1941.]

The serological (precipitation) method was found in the writers' studies at the Central Quarantine Laboratory, Moscow [cf. *R.A.M.*, xix, p. 73], to give the most reliable and rapid results in the diagnosis of *Aplanobacter michiganense* on tomatoes [ibid., xviii, p. 422]. In the examination of 314 strains of pure cultures of various bacteria, including 147 of *A. michiganense*, the precipitation technique gave 96·2 per cent. indisputably correct results, 3·2 per cent. doubtful, and 0·6 per cent. erroneous; in the case of healthy and diseased plant extracts 10 per cent. of the precipitation reactions were doubtful and 2·4 per cent. incorrect, compared with 82 per cent. correct with the use of the Gram stain. Bacterial antigens from infected tomato plants should be prepared at 60° C. in a period of 30 minutes.

Bewley (W. F.). **Tomato Vetomold.**—*Gdnrs' Chron.*, Ser. 3, cx, 2868, p. 220, 1941.

Full particulars are given of the growth habit and other characteristics of the Vetomold tomato variety, reference to the outstanding resistance of which to leaf mould (*Cladosporium fulvum*) in England has already been made [*R.A.M.*, xx, p. 437; and above, p. 122]. The seeds of the new variety, which is the offspring of a cross between the red currant tomato (*Lycopersicum pimpinellifolium*) and the Potentate variety, were first received at the Cheshunt Research Station from the Ontario Horticultural Experiment Station in 1939, and further supplies were received in 1940 and distributed among 95 growers throughout the country. The reports so far to hand concerning the performance of Vetomold are uniformly encouraging.

Wager (V. A.). **Blossom-end rot of Tomatoes.**—*Fmg S. Afr.*, xvi, 188, p. 375, 1 fig., 1941.

A brief account is given in popular terms of blossom-end rot of tomatoes [*R.A.M.*, xix, p. 169] and of its control by suitable cultural practices.

Conners (I. L.), McCallum (A. W.), & Bier (J. E.). **Willow blight in British Columbia.**—*Phytopathology*, xxxi, 11, pp. 1056–1058, 1 fig., 1941.

Although willow [*Salix*] blight has been known in the eastern United States and Canada for over a decade, the present report (1940) appears to be the first of its occurrence in British Columbia, where *Physalospora miyabeana* was observed on twig cankers collected at Abbotsford in both the perithecial and conidial stages, while *Fusicladium saliciperdum* was also identified in one specimen received [*R.A.M.*, xviii, p. 827]. An examination of the affected trees *in situ* revealed cankers 2 to 4 cm. long on twigs 2 to 7 mm. in diameter, the girdling of which was followed

by the death of the terminal shoots and its foliage. The disease was first observed about three or four years ago. The 20-year-old tree bearing the heaviest infection and three smaller ones were destroyed, and no further foci of the disease were detected in the lower Fraser River valley or near Victoria. Opinions are divided as to the relative importance of *P. miyabeana* and *F. saliciperdum*, which are constantly associated, in the etiology of the blight; in the present instance the former predominated.

Fresa (R.). **Royas que atacan al Álamo híbrido italiano 'Arnaldo Mussolini' en el Delta del Paraná (Argentina).** [Rusts that attack the hybrid Italian Poplar 'Arnaldo Mussolini' in the Paraná Delta (Argentina).]—*Rev. argent. Agron.*, viii, 1, pp. 19–24, 2 pl., 2 graphs, 1941.

Early in April, 1938, grafts of the hybrid poplar 'Arnaldo Mussolini' (*Populus canadensis* × *P. nigra stella* I), imported from Italy and planted four months earlier in the Paraná Delta nursery, were observed to bear the uredosori of a rust, and in the following year there was a severe recurrence of infection, accompanied in this case by the teleutosori of a species of *Melampsora*, which also developed in 1940 on a new batch of imported grafts. A microscopic study of the diseased material revealed the presence of two rusts, of which one is referred to *M. larici-populina*, occurring in the Argentine on *P. nigra* var. *italica* [*R.A.M.*, xvi, p. 5; xvii, p. 83], and the other (tentatively) to *M. albertensis*, recorded by Dietel (*Rev. sudamer. Bot.*, iv, p. 80, 1937) from the Argentine and Uruguay on *P. carolinensis*. Both species belong to the partially smooth-spored group of *Melampsora*, echinulations being absent from the apex of the uredospores of *M. larici-populina* and from the middle of those of *M. albertensis*; the dimensions of the former species are 25·2 to 50·4 by 11·2 to 28 μ (mean length 36·4 μ), and those of the latter 19·6 to 42 by 11·2 to 25·2 (28) μ. The doubt as regards the identity of *M. albertensis* in the case under observation rests on the close similarity between this species and *M. medusae*, the average dimensions of the uredospores of which are 22 to 30 by 15 to 18 μ, compared with 23 to 32 by 15 to 22 μ in *M. albertensis*, but the median thickening of the spores characteristic of *M. medusae* was not observed in the author's material.

Attempts should be made to control the rusts by the selection for propagation of highly resistant individuals of the hybrid.

Graves (A. H.). **Breeding work towards the development of a timber type of blight-resistant Chestnut: report for 1940.**—*Bull. Torrey bot. Cl.*, lxviii, 9, pp. 667–674, 1 fig., 1941.

In this progress report on chestnut breeding for resistance to blight [*Endothia parasitica*: *R.A.M.*, xx, p. 140] data are given of further hybrids made in 1940 at Hamden, Connecticut, and of the distribution of hybrids for testing to co-operative plantations in five of the eastern United States. Notes are also given on variation in *Castanea dentata*.

Davis (W. C.). **Damping-off of Longleaf Pine.**—*Phytopathology*, xxxi, 11, pp. 1011–1016, 1941.

The peculiar rosette-like habit of growth assumed by longleaf pine

(*Pinus palustris*) in its seedling and early sapling years entails certain departures from the norm in the symptomatology and etiology of damping-off, which in turn necessitate modifications in the ordinary methods of control. The initial phase of infection is characterized by water-soaking and a purplish discoloration of the cotyledon bases, the lower needles, and the hypocotyl of the seedling. The roots decay rapidly from the soil-line to a depth of $\frac{3}{4}$ in., while the remainder of the root system persists for so long as to indicate that organisms other than the primary invader are concerned in its disintegration. At a later stage the needles turn yellow, then brown, and droop. The rosette-like development of the seedling precludes the visible decay of the hypocotyl and collapse typical of damping-off in other pines, while another distinctive feature is that the agent or agents of the disease, which generally appear to enter at or just below the cotyledonary whorl, spread rapidly only in the tissues at or immediately beneath soil-level.

A species of *Rhizoctonia* was the most frequent isolate from diseased *P. palustris* seedlings in North and South Carolina nurseries and one in Mississippi between 1937 and 1940; affected nursery stock also occasionally yielded *Fusarium* and *Trichoderma* spp., while *Botrytis* sp. predominated in greenhouse tests.

The normal period of susceptibility to damping-off is considerably prolonged in the case of longleaf pine by its unusual growth habit. The most uniformly successful chemical control of the disease was obtained by sprinkling the seedlings with semesan at the rate of $\frac{1}{10}$ avoirdupois oz. to $\frac{3}{4}$ pt. water per sq. ft. seed-bed area, while in some tests ferrous sulphate and orthophosphoric acid, separately or combined at the time of sowing, gave promising results in some nurseries. In most nurseries the use of highly viable seed, sown in shallow rows and covered with $\frac{1}{4}$ in. layer of old sawdust, or broadcasted, firmed in the soil, and covered with sawdust, will probably afford the most practical methods of control. Cultural practices tending to keep the seedling bases free of soil should be adopted.

HADDOW (W. R.). **On the history and diagnosis of Polyporus tomentosus Fries, Polyporus circinatus Fries and Polyporus dualis Peck.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 179–190, 1 pl., 1941.

Polyporus tomentosus, *P. circinatus*, and *P. dualis* occur rather commonly in the coniferous forests of northern Ontario, where they cause a characteristic and destructive butt rot of their hosts, but correct diagnosis presents difficulty, owing to the existence of conflicting descriptions of these species. From an examination of authentic specimens and a comparative study of many collections from Europe and America, the author concludes that two closely similar forms exist, namely, *P. tomentosus* and *P. circinatus*, which are common to Europe and America. *P. dualis* is identical with *P. circinatus*. Both forms vary widely in size, habit, stratification of the context, depth of pore layer, and so forth, according to age and habitat, and cultural experiments showed that each comprises several strains differing in cultural characters. All the specimens studied exhibited a duplex structure. The relative thickness of the two layers varies, however, immensely. The lower stratum is hard, sometimes becoming vitreous when dried, and consists of more or less

straight, radiating hyphae. The upper stratum is soft, and composed of hyphae which, though derived from those of the inferior layer, are crooked, branched, and erect, the whole forming a loose, felty tomentum, often of considerable thickness. The typical difference between the forms lies in the shape of the setal elements of the hymenium, which in *P. tomentosus* are straight, and in *P. circinatus* strongly curved or hooked. As there is no other reliable diagnostic criterion, *P. circinatus* is considered to be a variety of *P. tomentosus* and is renamed *P. tomentosus* var. *circinatus* comb. nov. A revised description of the species is appended.

JOHNSON (J. W.). **Silver nitrate as a stain for use in studies of conduction of liquids in wood.**—*Phytopathology*, xxxi, 11, pp. 1035–1039, 2 figs., 1941.

A technique is described for staining green wood tissues to indicate clearly the pattern of primarily longitudinal liquid movements in wood. The stain solutions were injected into the wood block through a rubber tube fitted over the end, pressure causing a rapid flow of the stain through the wood. A 2·5 per cent. solution of silver nitrate in 20 per cent. ethyl alcohol proved to be the most effective of the stains tested. It was applied for two minutes, after which the sample was removed, split longitudinally, placed in elon-hydroquinone developer for 30 seconds, then in acid hypo for one minute, washed for ten minutes, and finally dried.

VERRALL (A. F.). **Dissemination of fungi that stain logs and lumber.**—*J. agric. Res.*, lxiii, 9, pp. 549–558, 1941.

Data collected over a period of ten years by the New Orleans Branch of the Division of Forest Pathology in Louisiana and Mississippi show that of the fungi causing stain in logs and timber [*R.A.M.*, xx, p. 388], *Ceratostomella pilifera, C. ips, C. pluriannulata, Endoconidiophora coerulescens, Graphium rigidum*, and *Diplodia natalensis* are disseminated by means of air currents and insects, the first five of these species by milling machinery, and *C. pilifera, C. ips, E. coerulescens*, and *D. natalensis* by the transport of infected wood. Rain water is probably of little importance since the wood inoculated by this means usually dries too rapidly for stain to develop. In well-constructed seasoning piles it does not penetrate to the interior of the piles where the most severe staining occurs. Although most staining fungi are disseminated by various means, *C. ips* and probably *C. pini* are chiefly carried by the bark beetles with which they are specifically associated. In discussing the relative importance of various means of dissemination, it is suggested that although air-borne spores are of less importance now than before chemical treatments were in common use, they still remain potentially important, as they may infect untreated timber or treated timber during prolonged wet periods when chemical treatments are less effective. Of the insects, only ambrosia beetles infecting hardwood logs and green timber of susceptible species, and bark beetles infecting pine logs, are of practical importance, as apparently none of the commercial stain-controlling chemicals in common use have any repellent effect on these two groups of beetles. Dissemination during the milling

process is considered of little importance owing to use of chemical treatments, but gains importance only when the timber is untreated. Dissemination by the transport of infected wood may be important in causing 'sticker stain', when stained, green, cross stickers are used in constructing seasoning piles. It was observed that slabs, edgings, and similar green material are suited to the production of spores in large numbers, thus forming a source of infection, but that old and weathered debris is not. With hardwoods, fruiting of staining fungi is common on the ends of logs and timber cut from stained logs. It is recommended, therefore, that sanitation in and around seasoning yards should include restriction of accumulations of green refuse of both pine and hardwood and wider use of chemical treatments for hardwood log ends.

Badcock (E. C.). **New methods for the cultivation of wood-rotting fungi.**—*Trans. Brit. mycol. Soc.*, xxv, 2, pp. 200–205, 2 pl., 1941.

The author describes tests with a new medium for the cultivation of wood-rotting fungi, consisting of sawdust from any species of wood that readily decays, such as beech or spruce, well mixed with 5 per cent. by weight of an 'accelerator' composed of maize meal, bone meal, potato starch, sucrose, and wood ash from the combustion of Scots pine sapwood (50, 30, 17, 2, and 1 parts by weight, respectively). On this, exceptionally vigorous growth was obtained with 20 species of wood-destroying fungi, eight species forming fruit bodies, whereas the growth on sawdust alone always was decidedly inferior and non-fruiting. In tests of the effects of the constituents of the accelerator on the growth of *Merulius lacrymans* both maize and bone meal exerted a pronounced stimulating effect. With timbers containing substances toxic to fungi it is frequently difficult to obtain growth from inoculum on malt agar, but in trials with 25 fungi grown on sawdust plus accelerator inoculated on samples of *Thuja plicata* only five made no growth and some caused bad decay. The medium would therefore appear to be highly suitable for growing organisms to be used in tests on the resistance to decay of naturally durable timbers, or for cultivating the fungi used in the laboratory testing of wood preservatives. The addition of the accelerator to garden soil (20 per cent. by weight) or cotton-wool (sprinkled lightly) also made a suitable medium. By the cotton-wool method inocula can be rapidly prepared for infecting timber in an experimental floor, mine, toxicity chamber, or living tree, the chief advantage being that the inocula can be nailed or tied in almost any position and will probably remain moist long enough for the fungus to grow on to the test material. If necessary, the inocula can be watered.

Prevention and control of decay in dwellings.—*Tech. Notes For. Prod. Lab., Wis.*, 251, 4 pp., 1941.

In this note the cardinal principles of good building practice for the avoidance of decay in timber in new buildings are summarized in the form of eight rules, designed to prevent damp. Directions are also given for the repair of buildings already damaged by decay, the first thing to be done being to determine the source of the moisture and remove it.